

Taxonomic revision of the ant (Hymenoptera: Formicidae) genus *Paraparatrechina* in the Afrotropical and Malagasy Regions

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Abstract

The taxonomy of the Afrotropical and Malagasy *Paraparatrechina* fauna is revised for the first time. Thirteen species are revealed, of which eight are described as new: *P. brunnella* LaPolla & Cheng; *P. concinnata* LaPolla & Cheng; *P. gnoma* LaPolla & Cheng; *P. myops* LaPolla & Fisher; *P. ocellatula* LaPolla & Fisher; *P. oreias* LaPolla & Cheng; *P. splendida* LaPolla & Cheng; *P. umbranatis* LaPolla & Cheng. An identification key to the worker caste is provided.

Key words: Formicinae, *Nylanderia*, *Paratrechina*, *Prenolepis* genus-group

Introduction

Recently LaPolla *et al.* (2010) elevated the formerly synonymized ant subgenus *Paraparatrechina* Donisthorpe (1947) to genus rank based on both morphological and molecular data. A full diagnosis of the genus is provided by LaPolla *et al.* (2010), but in summary *Paraparatrechina* are small (typically around 1–2 mm in total length) formicine ants, which often reflect a metallic iridescence (blue, purple and pink hues have been observed) under light microscopy. In darker species, the iridescence tends to be a darker bluish-purple, while lighter colored species either show little iridescence or reflect a more pinkish-purple hue. *Paraparatrechina* are usually easily distinguishable from other formicine genera by a unique mesosomal setal pattern: two pairs of erect setae on the pronotum, one pair on the mesonotum and one pair on the propodeum. *Nylanderia*, the genus most likely confused with *Paraparatrechina*, never possesses a pair of erect setae on the propodeum. The mandibles of *Paraparatrechina* also possess five teeth, while in *Nylanderia* six teeth are usually present.

Paraparatrechina is restricted to the Palearctic. Only five species of *Paraparatrechina* were known from the Afrotropical and Malagasy regions prior to this study (LaPolla *et al.*, 2010). Therefore, this study, with the description of 8 new species, increases the known species richness of *Paraparatrechina* in these regions by nearly two-thirds. Twenty-five species and subspecies are currently known from Asia and Australia, although preliminary study suggests that there are many undescribed species, and the species total for the region will change once a revision of the fauna is completed (S. Shattuck, pers. comm.).

One of the more surprising results of the LaPolla *et al.* (2010) study was that the two Afrotropical species formerly placed in *Pseudolasius* (*bufonus* and *weissi*), were found to belong in *Paraparatrechina*, with strong measures of clade support. This small group was treated by LaPolla (2004) and found to contain two valid species. The placement of *bufonus* and *weissi* within *Paraparatrechina* is elaborated upon in LaPolla *et al.* (2010) and we do not treat these species here as part of this revision, although they are listed in the provided key. Examination of the male genitalia of *P. albipes* and *P. glabra* in this study (fig. 15) revealed that the

parameres and penis valve structures of these two species are very similar to the same structures described for *P. bufonus* (LaPolla, 2004), adding additional morphological support for the placement of *P. bufonus* and *P. weissii* within *Paraparatrechina*.

Very little is known about the biology of *Paraparatrechina* in the Afrotropical and Malagasy regions. They have been found in a wide range of tropical habitats from rainforests to forest clearings in sifted leaf litter, rotten logs, under stones, and from beating vegetation and fogging samples from the forest canopy. Most of the specimens we examined for this study were the results of leaf litter survey work, but some *Paraparatrechina* may live above the leaf litter in vegetation or higher up in the canopy, as several species were collected by beating vegetation or fogging.

We report here the first taxonomic revision of *Paraparatrechina* in the Afrotropical and Malagasy regions. A total of thirteen species are revealed and a key to the species is provided.

Material and Methods

Specimens examined for this study are deposited in the following institutions:

BMNH	Natural History Museum, London, UK
CASC	California Academy of Sciences, San Francisco, USA
MHNG	Muséum d' Histoire Naturelle, Geneva, Switzerland
MSNG	Museo Civico di Storia Naturale "Giacomo Doria", Genova, Italy
NHMB	Naturhistorisches Museum, Basel, Switzerland
SAMC	South African Museum, Cape Town, South Africa
USNM	National Museum of Natural History, Washington, D.C., USA

All measurements were taken at various powers with a Nikon microscope using a orthogonal pair of micrometers and recorded to the nearest 0.001 mm and rounded to two decimal places for presentation. All measurements are given in millimeters. Digital color images were created using a JVC KY-F75 digital camera and Syncroscopy Auto-Montage (v 5.0) software. Morphological terminology for measurements and indices employed throughout are defined below (following Bolton, 1994 and Ward, 2001 with modifications).

EL (Eye Length): maximum length of compound eye in full-face view.

GL (Gaster Length): the length of the gaster in lateral view from the anteriormost point of first gastral segment (third abdominal segment) to the posteriormost point.

HL (Head Length): the length of the head proper, excluding the mandibles; measured in full-face view from the midpoint of the anterior clypeal margin to a line drawn across the posterior margin from its highest points (to accommodate species where the posterior margin is concave).

HW (Head Width): the maximum width of the head in full-face view (in males, portion of the eyes that extends past the lateral margins of the head is included).

PW (Pronotal Width): the maximum width of the pronotum in dorsal view.

PDH (Propodeum Height): height of the propodeum as measured in lateral view from the base of the metapleuron to the maximum height of the propodeum.

PrFL (Profemur Length): the length of the profemur from its margin with the coxa anteriorly to its margin with the tibia posteriorly.

PrFW (Profemur Width): the maximum width of the profemur.

SL (Scape Length): the maximum length of the antennal scape excluding the condyle

TL (Total Length): $HL + WL + GL$

WL (Weber's Length): in lateral view, the distance from the posteriormost border of the metapleural lobe to the anteriormost border of the pronotum, excluding the neck.

CI (Cephalic Index): $(HW/HL) \cdot 100$

FI (Profemur Index): $(FW/FL) \cdot 100$

REL (Relative Eye Length Index): $(EL/HL) \cdot 100$

SI (Scape Index): $(SL/HW) \cdot 100$

Synopsis of *Paraparatrechina* species in the Afrotropical Region

albipes (Emery, 1899). Widespread throughout West Africa.

brunnella LaPolla and Cheng, **sp. nov.** Cameroon, Gabon, Ghana and Kenya.

bufonus (Wheeler, W.M., 1922). Cameroon and Congo (D.R.).

concinata LaPolla and Cheng, **sp. nov.** Cameroon, Central African Republic and Gabon.

gnoma LaPolla and Cheng, **sp. nov.** Ghana and Nigeria.

oreias LaPolla and Cheng, **sp. nov.** Cameroon.

splendida LaPolla and Cheng, **sp. nov.** Gabon and Uganda.

subtilis (Santschi, 1920). Widespread throughout West Africa, eastward to Rwanda.

= *subtilis termitophila* (Santschi, 1921), **syn. nov.**

umbranatis LaPolla and Cheng, **sp. nov.** Angola, Gabon and Kenya.

weissi (Santschi, 1910). Widespread throughout West Africa to Uganda and southern Sudan.

= *bayonii* (Menozzi, 1924)

= *bucculentus* (Wheeler, W.M., 1922)

= *gowdeyi* (Wheeler, W.M., 1922)

= *myersi* (Weber, 1943)

= *myersi occipitalis* (Weber & Anderson, 1950)

= *weissi sordidus* (Santschi, 1914)

Synopsis of *Paraparatrechina* species in the Malagasy Region

glabra (Forel, 1891). Widespread across Madagascar.

myops LaPolla and Fisher, **sp. nov.** Mountainous regions of Madagascar.

ocellatula LaPolla and Fisher, **sp. nov.** Mountainous regions of Madagascar.

Key to *Paraparatrechina* workers in the Afrotropical and Malagasy Regions

1. Eyes small relative to head length ($REL \leq 16$)..... 2
- Eyes medium to large relative to head length ($REL \geq 17$) 5
2. Eyes consisting of less than 10 facets; polymorphic, with clearly expressed major caste; West Africa 3
- Eyes consisting of more than 10 facets; monomorphic; Madagascar..... 4
3. Head, scapes, and legs with numerous erect setae..... *bufonus*
- Head with only sparsely scattered erect setae; scapes and legs without erect setae..... *weissi*
4. Scape with decumbent pubescence; scapes surpass posterior margin by approximately length of the first 3–4 funicular segments *myops*
- Scape with appressed pubescence; scapes surpass posterior margin by approximately length of the first 2–3 funicular segments..... *ocellatula*
5. Mesosoma elongate in lateral view, with pronotum gently rising towards mesonotum..... 6
- Mesosoma compact in lateral view, with pronotum steeply rising towards mesonotum 8
6. Propodeum with a short, angular dorsal face, and a long declivitous face; scape length <0.6 mm; Madagascar.....
- *glabra*
- Propodeum with rounded dorsal face, not conspicuously longer than declivitous face; scape length >0.6 mm; East & West Africa 7
7. Scape length >0.72 mm; tibiae same brown color as mesosoma; protrochanter brown as in mesosoma, but meso/metatrochanters may be lighter brown; mandibles and antennae typically same brown color as head..... *splendida*
- Scape length <0.72 mm; tibiae whitish to brownish-yellow; all trochanters white; mandibles and antennae yellowish-brown, contrasting with brown head..... *concinata*
8. Yellow to brownish-yellow species, although may possess a conspicuously darker gaster that is brown in color..... 9
- Brown to dark brown species with the gaster the same color as the head and mesosoma 12
9. Gaster brown, conspicuously contrasting with yellow head and mesosoma..... *umbranatis*
- Gaster brownish-yellow to yellow, not conspicuously contrasting with head and mesosoma 10

10. Smaller species (HL & SL < 0.4 mm) *gnoma*
- Larger species (HL & SL > 0.4 mm) 11
11. Head and scapes with decumbent pubescence; REL \leq 22 *subtilis*
- Head and scapes with appressed pubescence; REL \geq 23 *oreias*
12. Mesosomal dorsum (primarily pronotum and mesonotum) much lighter (almost white in some specimens) than remainder of mesosoma, head and gaster; white colored pubescence covering body *albipes*
- Mesosomal dorsum not much lighter than remainder of mesosoma, head and gaster; golden colored pubescence covering body *brunnella*

Species Accounts

Afrotropical Species

Paraparatrechina albipes (Emery, 1899)

(Figs. 1, 2, 15A–E, 16, 17)

Prenolepis albipes Emery, 1899: 497 (worker described). 2 syntype workers? (see below), CAMEROON, IX–XI 1895, L. Conradt (MCSN) [examined]. The description mentions two specimens, which are assumed to have been workers since only workers were described by Emery, but of the two specimens labeled types for this species in MSNG, one of them is a queen. It remains unclear if this specimen is one of the syntypes or not, although a queen was not mentioned in the original description. Emery, 1914: 422, combination in *Prenolepis* (*Nylanderia*); Emery, 1925: 218, combination in *Paratrechina* (*Nylanderia*); LaPolla *et al.*, 2010: 128, combination in *Paraparatrechina*.

Worker diagnosis: mesosomal dorsum (primarily pronotum and mesonotum) much lighter (almost white in some specimens) than remainder of mesosoma, head and gaster; white pubescence covering body.



FIGURE 1. *Paraparatrechina albipes* worker CASENT0178759. A, profile; B, dorsum; C, full face.

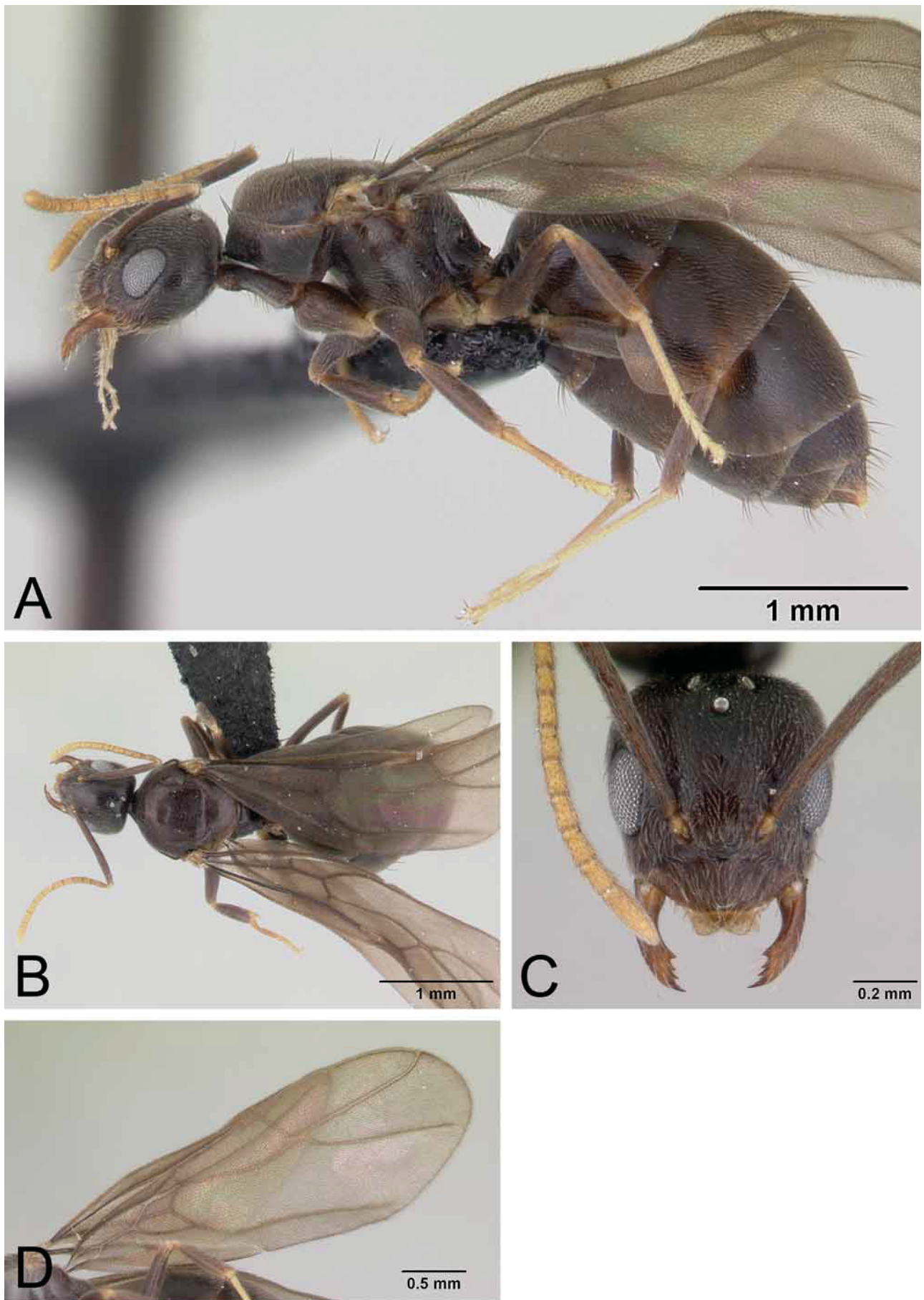


FIGURE 2. *Paraparatrechina albipes* queen CASENT0088326. A, profile; B, dorsum; C, full face; D, forewing.

Compare with: *P. brunnella*.

WORKER. *Measurements* ($n=20$): TL: 1.41–1.89; HW: 0.35–0.42; HL: 0.39–0.47; EL: 0.11–0.13; SL: 0.48–0.53; PW: 0.24–0.31; WL: 0.48–0.55; PDH: 0.20–0.25; PrFL: 0.38–0.42; PrFW: 0.11–0.15; GL: 0.52–0.9. *Indices*: CI: 81–93; REL: 26–29; SI: 119–140; FI: 27–37

Head brown, with contrasting yellowish-brown antennae and mandibles; head slightly longer than broad. White colored pubescence covers head in neat longitudinal rows. Scapes surpass posterior margin by about the length of the first 2–3 funicular segments. Lateral parts of mesosoma brown, and typically a distinctly white to whitish-yellow patch covers the dorsum of the pronotum and mesonotum, with the dorsum of the propodeum whitish to lighter brown. Fine, white pubescence covers entire mesosomal dorsum. Pronotum rises slightly more than 45° from anterior margin to dorsum; mesosoma compact; propodeum dorsum gently rounded. Procoxae brown, meso/metacoxae and trochanters white. Femurs brown posteriorly becoming white towards anterior ends; tibiae and tarsi white; gaster brown, sometimes slightly lighter colored around segmental margins.

QUEEN. *Measurements* ($n=1$): TL: 4.28; HW: 0.744; HL: 0.74; EL: 0.29; SL: 0.84; PW: 0.91; WL: 1.30; PDH: 0.52; PrFL: 0.73; PrFW: 0.19; GL: 2.24. *Indices*: CI: 100; REL: 39; SI: 113; FI: 27

As in worker, with modifications expected for caste. The queen examined does not display the lighter colored mesosomal dorsum observed in workers of this species and is darker brown overall in coloration.

MALE. *Measurements* ($n=1$): TL: 1.63; HW (including eyes): 0.41; HL: 0.37; EL: 0.17; SL: 0.33; PW: 0.34; WL: 0.63; PrFL: 0.44; PrFW: 0.08; GL (including parameres): 0.67. *Indices*: CI: 112; REL: 46; SI: 80; FI: 19

Head brown, with bulging large eyes that occupy most of the lateral region of the head; head slightly broader than long. Palps distinctly lighter than head in color. A dense layer of pubescence covers head, with scattered erect setae along mid-region, posterior margin and clypeus. Scapes surpass posterior margin by about length of the first 2 funicular segments; antennae 13-segmented. Mandible with apical tooth and an indistinct basal angle. Mesosoma same color as head; pronotum short and collar-like; mesonotum large, rounded anteriorly, overarched pronotum; mesosoma dorsum flat, with suberect setae. Gaster slightly darker brown than head and mesosoma, covered with pubescence and scattered erect setae. Parameres elongate, with scattered erect setae, especially towards apices.

Non-type material examined: **CAMEROON:** Nkoemvon, 1980 (D. Jackson); Prov. Sud-Quest, Bimbia Forest, 7.4 km 119° ESE Limbe, 9° 15.8' E, 3° 58.9' N, 14.iv.2000, elev. 40 m (B.L. Fisher); Prov. Sud. Res. Campo, Massif des Mamelles, 15.1 km 18° E Ebodje, 9° 57.6' E, 2° 35.7' N, 4.iv.2000, elev. 180 m (B.L. Fisher); Prov. Sud, PN Campo, 43.3 km 108° ESE Campo, 10° 12.4' E, 2° 17.0' N, 7.iv.2000, elev. 290 m (B.L. Fisher); **CENTRAL AFRICAN REPUBLIC:** PN Dzanga-Ndoki, Mabea Bai, 21.4 km 53° NE Bayanga, 16° 24.36' E, 3° 2.0' N, 4.v.2001, elev. 510 m (S. van Noort); PN Dzanga-Ndoki, 21.4 km 53° NE Bayanga, 16° 24.57' E, 3° 2.1' N, 5.v.2001, elev. 510 m (S. van Noort); PN Dzanga-Ndoki, Mabea Bai, 21.4 km 53° NE Bayanga, 16° 25' E, 3° 2' N, 1–7.v.2001, elev. 510 m (B.L. Fisher); PN Dzanga-Ndoki, 38.6 km 173° S Lidjombo, 16° 3.20' E, 2° 21.60' N, 25.v.2001, elev. 350 m (S. van Noort); Res. Dzanga-Sangha, 12.7 km 326° NW Bayanga, 16° 11.55' E, 3° 0.27' N, 13.v.2001, elev. 420 m (S. van Noort); Res. Dzanga-Sangha, 12.7 km 326° NW Bayanga, 16° 12' E, 3° 0' N, 10–17.v.2001, elev. 470 m (B.L. Fisher); Res. Dzanga-Sangha, 12.7 km 326° NW Bayanga, 16° 12' E, 3° 0' N, 10–17.v.2001, elev. 370 m (B.L. Fisher); **GABON:** La Makande, Forêt des Abeilles, i.–ii.1999 (S. Lewis); Prov. Estuaire Pointe Ngombe, Ekwata, 16 km 240° WSW Libreville, 9° 18.7' E, 0° 19.5' N, 27.iii.2000, elev. 5 m (B.L. Fisher); Prov. Ogooue-Maritime, Res. Moukalaba, 12.2 km 305° NW Doussala, 10° 29.8' E, 2° 17.0' S, 24.ii.2000, elev. 110 m (B.L. Fisher); Prov. Ogooue-Maritime, Res. Moukalaba, 10.8 km 214° SW Doussala, 10° 32.7' E, 2° 25.4' S, 29.ii.2000, elev. 110 m (B.L. Fisher); Prov. Ogooue-Maritime, Res. Monts Doudou, 24.3 km 307° NW Doussala, 10° 24.4' E, 2° 13.4' S, 6.iii.2000, elev. 375 m (B.L. Fisher); Prov. Ogooue-Maritime, Reserve des Monts Doudou, 24.3 km 307° NW Doussala, 10° 24.35' E, 2° 13.35' S, 8.iii.2000, elev. 370 m (S. van Noort); Prov. Ogooue-Maritime, Res. Monts Doudou, 25.2 km 304° NW Doussala, 10° 23.7' E, 2° 13.6' S, 14.iii.2000, elev. 640 m (B.L. Fisher); Prov. Ogooue-Maritime, Reserve des Monts Doudou, 25.2 km 304° NW Doussala, 10° 23.67' E, 2° 13.63' S, 16.iii.2000, elev. 600 m (S. van Noort); Prov. Ogooue-Maritime, Reserve de la Moukalaba-

Dougoua, 12.2 km 305° NW Doussala, 10° 29.83' E, 2° 17.0' S, 2.iii.2000, elev. 110 m (S. van Noort); Prov. Ogooue-Maritime, Reserve de la Moukalaba-Dougoua, 7 km NW Doussala, 10° 32.65' E, 2° 19.84' S, 21.iii.2000, elev. 110 m (S. van Noort); Prov. Woleu-Ntem, 31.3 km 108° ESE Minovoul, 12° 24.4' E, 2° 4.8' N, 7.ii.1998, elev. 600 m (B.L. Fisher); **GHANA**: Bunso nr. Tafo, 17.iv.1992 (R. Belshaw); Bunso, 22.vii.1969 (D. Leston); Bunso, 18.vii.1969 (D. Leston); Afwerase, 8.v.1969 (P. Room); Asamankese, 5.ix.1969 (D. Leston); Asamankese, 28.iv.1970, (P. Room); Mampong, 26.i.1970 (P. Room); Tafo, 7.vii.1970 (B. Bolton); **NIGERIA**: Gambari, 10.vi.1969 (B. Bolton); Gambari, 18.vi.1969 (B. Bolton); Gambari, 15.vii.1969 (B. Bolton); Ibadan, 18.v.1981 (A. Russell-Smith); **TOGO**: Palime, Klouto For, 20–25.vi.1974 (Vit)

Notes. This species has an unusual coloration pattern and is usually easily identifiable, with most specimens exhibiting a striking white patch on the mesosomal dorsum that contrast strongly with the darker body. There is variation in the degree of how large and white the patch is, with some specimens barely exhibiting a white patch at all. Sometimes the patch can also be of a more yellowish color rather than white.

***Paraparatrechina brunnella* LaPolla and Cheng, sp. nov.**

(Fig. 3, 16, 17)

Holotype worker, CAMEROON: Nkoemvon; 1980; F49 (D. Jackson) (BMNH); 8 paratype workers, same locality as holotype (BMNH, NMNH).

Worker diagnosis: small size (TL 1.2–1.6); head, mesosoma, and gaster brown, contrasting with yellowish-brown antennae and mandibles; golden pubescence covering body (especially visible on head).

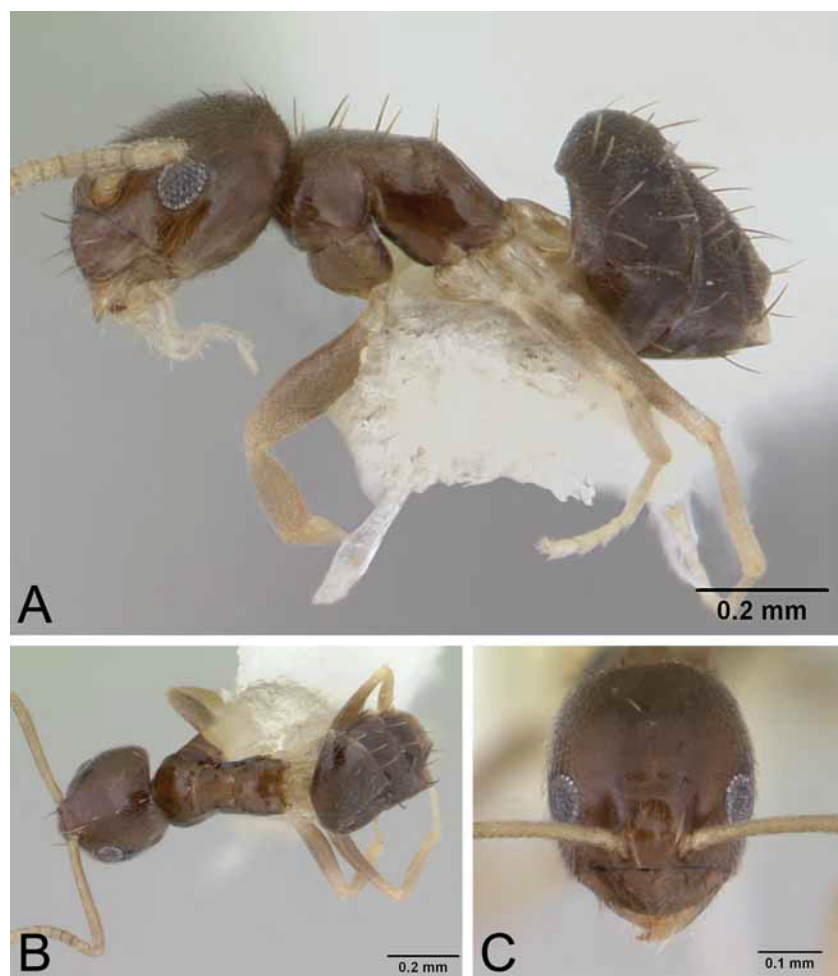


FIGURE 3. *Paraparatrechina brunnella* worker holotype CASENT0178757. A, profile; B, dorsum; C, full face.

Compare with: *P. albipes*

WORKER. *Measurements* ($n=10$): TL: 1.23–1.58; HW: 0.32–0.37; HL: 0.37–0.41; EL: 0.09–0.12; SL: 0.35–0.46; PW: 0.22–0.29; WL: 0.35–0.52; PDH: 0.19–0.25; PrFL: 0.29–0.37; PrFW: 0.1–0.12; GL: 0.45–0.65. *Indices*: CI: 81–94; REL: 23–28; SI: 102–124; FI: 30–38

Head brown, with contrasting yellowish-brown antennae and mandibles; cuticular surface shining; head slightly longer than broad. Golden pubescence covers head. Scares surpass posterior margin by about the length of the first funicular segment. Mesosoma brown and compact; fine golden pubescence covers entire dorsum of mesosoma. Pronotum rises steeply from anterior margin to dorsum. Propodeum low, with a very short, angular dorsal face followed by a long declivitous face; petiole yellowish-brown. Procoxae brown; meso/metacoxae whitish-yellow; trochanters white; femurs and tarsi yellowish-brown, becoming lighter towards last tarsal segments; gaster brown.

Etymology. The species epithet is a Latin diminutive adjective meaning brown and small, in reference to the main color of the body and the generally small size of ants in this genus.

Non-type material examined: **CAMEROON:** Nkoemvon, 1980 (D. Jackson); **GABON:** Prov. Ogooue-Maritime, Reserve de la Moukalaba-Dougoua, 7km NW Doussala, 10° 32.65' E, 2 19.84' S, 21.iii.2000, elev. 110 m (S. van Noort); **GHANA:** Tafo (B. Bolton); **KENYA:** Kakamega Forest, E 34° 52'16, N 00° 19.49 (H. Garcia).

Notes. *P. albipes* could be confused with this species if the pro/mesonotal white patch is not distinct on *P. albipes*. *P. brunnella* possess more pubescence on the head and mesosoma than *P. albipes*, and has a shorter scape (*brunnella* range: 0.35–0.46 mm compared with *albipes* range: 0.48–0.53 mm).

***Parapatrechina concinnata* LaPolla and Cheng, sp. nov.**

(Fig. 4, 16, 17)

Holotype worker, GABON: Prov. Ogooue-Martime; Res. Monts Doudou; 25.2 km 304° NW Doussala; 2°13.6' S, 10°23.7'E; 14.iii.2000; elev. 640 m (B.L. Fisher #2246) (CASC); 1 paratype worker, same locality as holotype; 6 paratype workers, GABON: Prov. Ogooue-Martime; Res. Moukalabala; 2.2 km 305° NW Doussala; 2°17.0'S, 10°29.8'E; 24.ii.2000; elev. 110 m (B.L. Fisher #2124). (CASC; USNM)

Worker diagnosis: mesosoma elongate (WL: 0.62–0.67); head distinctly longer than broad with long scapes; head brown, contrasting with yellowish-brown antennae and mandibles.

Compare with: *P. splendida*

WORKER. *Measurements* ($n=12$): TL: 1.73–2.16; HW: 0.38–0.43; HL: 0.49–0.53; EL: 0.12–0.15; SL: 0.63–0.69; PW: 0.27–0.32; WL: 0.62–0.67; PDH: 0.23–0.27; PrFL: 0.49–0.55; PrFW: 0.11–0.13; GL: 0.6–1.05. *Indices*: CI: 75–86; REL: 23–28; SI: 158–173; FI: 22–25

Head brown, with contrasting yellowish-brown antennae and mandibles; cuticular surface shining; head distinctly longer than broad. Golden pubescence covers head in neat longitudinal rows. Scares surpass posterior margin by about the length of the first 3–4 funicular segments. Mesosoma brown and elongate; golden pubescence covers entire dorsum of mesosoma in neat rows. Pronotum rise shallow, less than 45° from anterior margin to dorsum; propodeum low, with a long, rounded dorsal face; declivitous face longer. Procoxae brown, with meso/metacoxae typically whitish-yellow, although some specimens have completely brown coxae; trochanters white; femurs are lighter brown, with white tarsi; gaster brown.

Etymology. The species epithet is a Latin adjective for skillfully put together, in reference to the elongated, graceful mesosoma and head of this species.

Non-type material examined: **CAMEROON:** Abongmbang, 27.xi.1988 (A. Dejean); Bakundu, 8.xi.1990 (A. Dejean); Mbalmayo, xi.1991 (N. Stork); Mbalmayo, xi.1993 (N. Stork); Nkoemvon, viii.1979 (D. Jackson); Nkoemvon, 27.ii.1980 (D. Jackson); **CENTRAL AFRICAN REPUBLIC:** PN Dzanga-Ndoki, 21.4 km 53° NE Bayanga, 16° 24.57' E, 3° 2.1' N, 6.v.2001, elev. 510 m (S. van Noort); PN Dzanga-Ndoki, 38.6 km 173° S Lidjumbo, 16° 3.20' E, 3° 21.60' N, 26–27.v.2001, elev. 350 m (S. van Noort); PN Dzanga-Ndoki, Mabea Bai, 21.4 km 53° NE Bayanga, 16° 24.36' E, 3° 2.0' N, 4.v.2001, elev. 510 m (S. van Noort);

PN Dzanga-Ndoki, 38.6 km 173° S Lidjombo, 16° 3.20' E, 2° 21.60' N, 25.v.2001, elev. 350 m (S. van Noort); PN Dzanga-Ndoki, Mabea Bai, 21.4 km 53° NE Bayanga, 16° 25' E, 3° 2' N, 1–7.v.2001, elev. 510 m (B.L. Fisher); PN Dzanga-Ndoki, Mabea Bai, 21.4 km 53° NE Bayanga, 16° 25' E, 3° 2' N, 17.v.2001, elev. 510 m (B.L. Fisher); Res. Dzanga-Sangha, 12.7 km 326° NW Bayanga, 16° 11.55' E, 3° 0.27' N, 12–13.v.2001, elev. 420 m (S. van Noort); Res. Dzanga-Sangha, 12.7 km 326° NW Bayanga, 16° 12' E, 3° 0' N, 10–17.v.2001, elev. 420 m (B. L. Fisher); Res. Dzanga-Sangha, 12.7 km 326° NW Bayanga, 16° 11.55' E, 3° 0.27' N, 13.v.2001, elev. 420 m (S. van Noort); **GABON**: La Makande, Forêt des Abeilles, i.–ii.1999 (S. Lewis); Prov. Ogooue-Maritime, Reserve des Monts Doudou, 24.3 km 307° NW Doussala, 10° 24.35' E, 2° 13.35' S, 8–9.iii.2000, elev. 350 m (S. van Noort); Prov. Ogooue-Maritime, Res. Monts Doudou, 25.2 km 304° NW Doussala, 10° 23.7' E, 2° 13.6' S, 14.iii.2000, elev. 640 m (B.L. Fisher); Prov. Ogooue-Maritime, Res. Monts Doudou, 25.2 km 304° NW Doussala, 10° 23.67' E, 2° 13.63' S, 15.iii.2000, elev. 660 m (S. van Noort); Prov. Ogooue-Maritime, Res. Des Monts, 10° 23.40' E, 2° 13.38' S, 16.iii.2000, elev. 660 m (S. van Noort); Prov. Ogooue-Maritime, Res. Moukalaba, 12.2 km 305° NW Doussala, 10° 29.8' E, 2° 17.0' S, 24.ii.2000, elev. 110 m (B.L. Fisher); Prov. Ogooue-Maritime, Res. De la Moukalaba Dougoua, 12.2 km 305° NW Doussala, 10° 29.83' E, 2° 17.0' S, 29.ii.2000, elev. 110 m (S. van Noort)

Notes. This species is probably closely related to *P. splendida*, with whom it is most likely to be confused. See notes for *P. splendida* for further discussion.

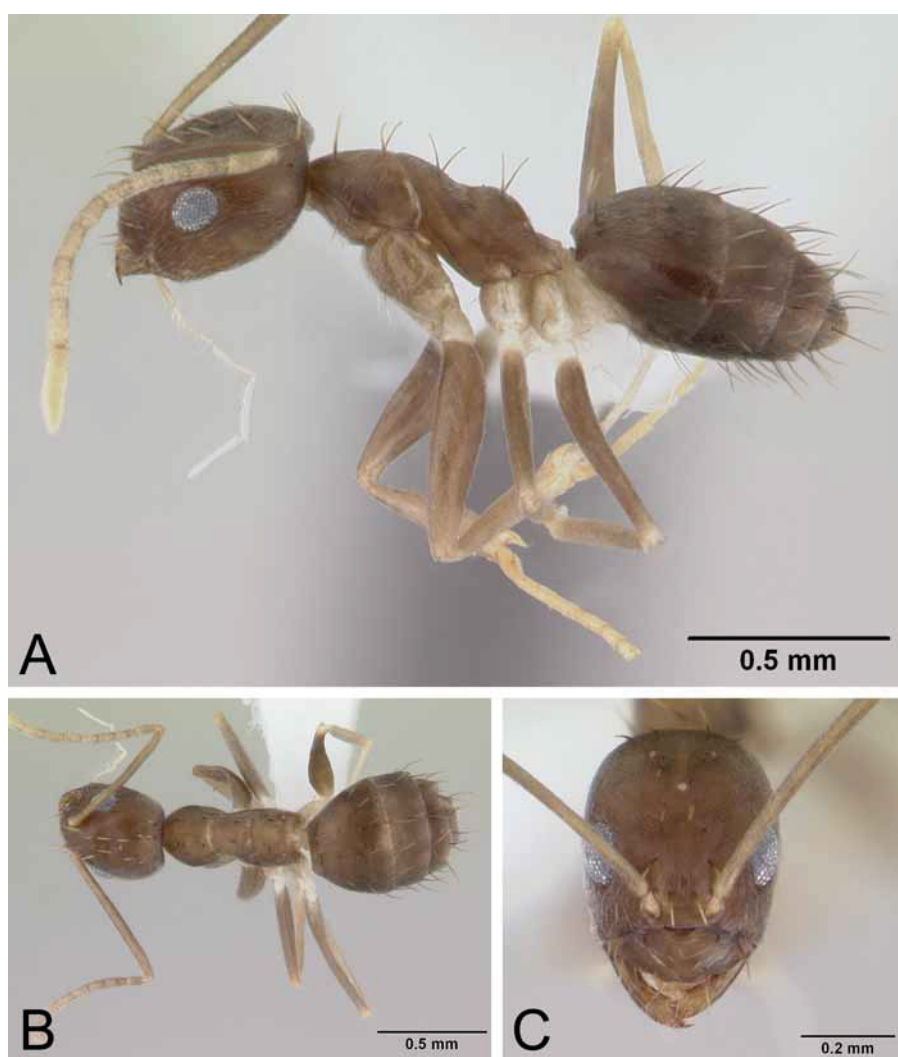


FIGURE 4. *Parapatrechina concinnata* worker holotype CASENT0178761. A, profile; B, dorsum; C, full face.

***Paraparatrechina gnoma* LaPolla and Cheng, sp. nov.**

(Fig. 5, 16, 17)

Holotype worker, GHANA: Mankrang For. Res. nr. Akomaden; 11.iii.1992 (R. Belshaw) (BMNH); 6 paratype workers, same locality as holotype (BMNH, USNM).

Worker diagnosis: Small size (TL: 1.2–1.44); HL & SL < 0.4 mm.

Compare with: *P. oreias* and *subtilis*

WORKER. Measurements ($n=12$): TL: 1.2–1.44; HW: 0.32–0.34; HL: 0.36–0.38; EL: 0.084–0.098; SL: 0.34–0.38; PW: 0.22–0.25; WL: 0.36–0.42; PDH: 0.19–0.21; PrFL: 0.28–0.30; PrFW: 0.09–0.11; GL: 0.47–0.67. **Indices:** CI: 85–94; REL: 24–26; SI: 102–115; FI: 32–36

Head brownish-yellow, with lighter yellow colored clypeus, mandibles, and antennae and area around torulae. A fine, short pubescence covers the head. Scares surpass posterior margin by about the length of the first 2 funicular segments. Mesosoma compact, laterally brownish-yellow, with dorsum lighter yellow, and a fine pubescence covering the entire mesosomal dorsum. Pronotum rises very steeply from anterior margin to dorsum; propodeum possesses a short, angular dorsal face, with a long declivitous face. Procoxae typically brownish-yellow as in mesosoma, although procoxae in some specimens are lighter yellow; overall, the legs are brownish-yellow, becoming yellow towards last tarsal segments; gaster brownish-yellow becoming lighter yellow around segmental margins.

Etymology. The species epithet is a Latin noun in apposition for dwarf, in reference to the fact that this is the smallest species of *Paraparatrechina* currently known from the Afrotropics.

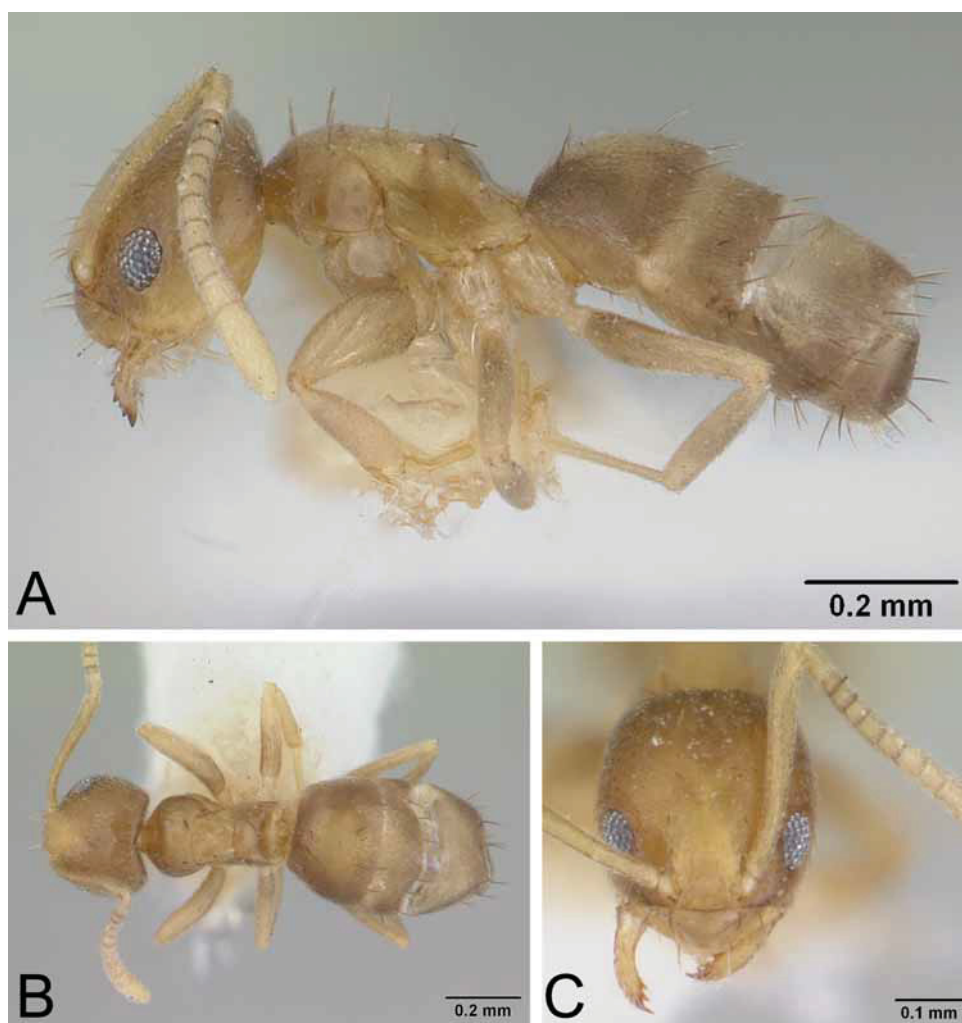


FIGURE 5. *Paraparatrechina gnoma* worker holotype CASENT0178758. A, profile; B, dorsum; C, full face.

Non-type material examined: GHANA: Enchi, 23.v.1969 (D. Leston); Enchi, 27.v.1969 (D. Leston); Enchi, 28.v.1969 (D. Leston); Mankrang For., Res. Nr. Akomadan, 11.iii.1992 (Belshaw); NIGERIA: Onipe, 25.vii.1975

Notes. This species is most likely to be confused with *P. oreias*, but can be separated by its overall smaller size in head width and length and scape length. *P. gnoma* is currently the smallest known Afrotropical *Paraparatrechina* species, although *P. brunnella* is very small as well (TL: 1.23–1.58).

***Paraparatrechina oreias* LaPolla and Cheng, sp. nov.**
(Fig. 6, 16, 17)

Holotype worker, CAMEROON: Prov. Sud-Ouest; Mnt. Cameroon; 3.8 km 330° NNW Mapanja; elev. 1440 m; 4°6.5'N, 9°9.1'E; 16.iv.2000 (B.L. Fisher #2326) (CASC); 8 paratype workers, same locality as holotype (CASC, USNM).

Worker diagnosis: metanotal area distinct, with raised metanotal spiracles; head and scapes with appressed pubescence.

Compare with: *P. gnoma* and *subtilis*

WORKER. Measurements ($n=10$): TL: 1.4–1.75; HW: 0.37–0.39; HL: 0.45–0.46; EL: 0.105–0.112; SL: 0.41–0.45; PW: 0.26–0.28; WL: 0.48–0.51; PDH: 0.21–0.23; PrFL: 0.34–0.36; PrFW: 0.098–0.14; GL: 0.45–0.83. **Indices:** CI: 80–87; REL: 23–25; SI: 105–120; FI: 28–40

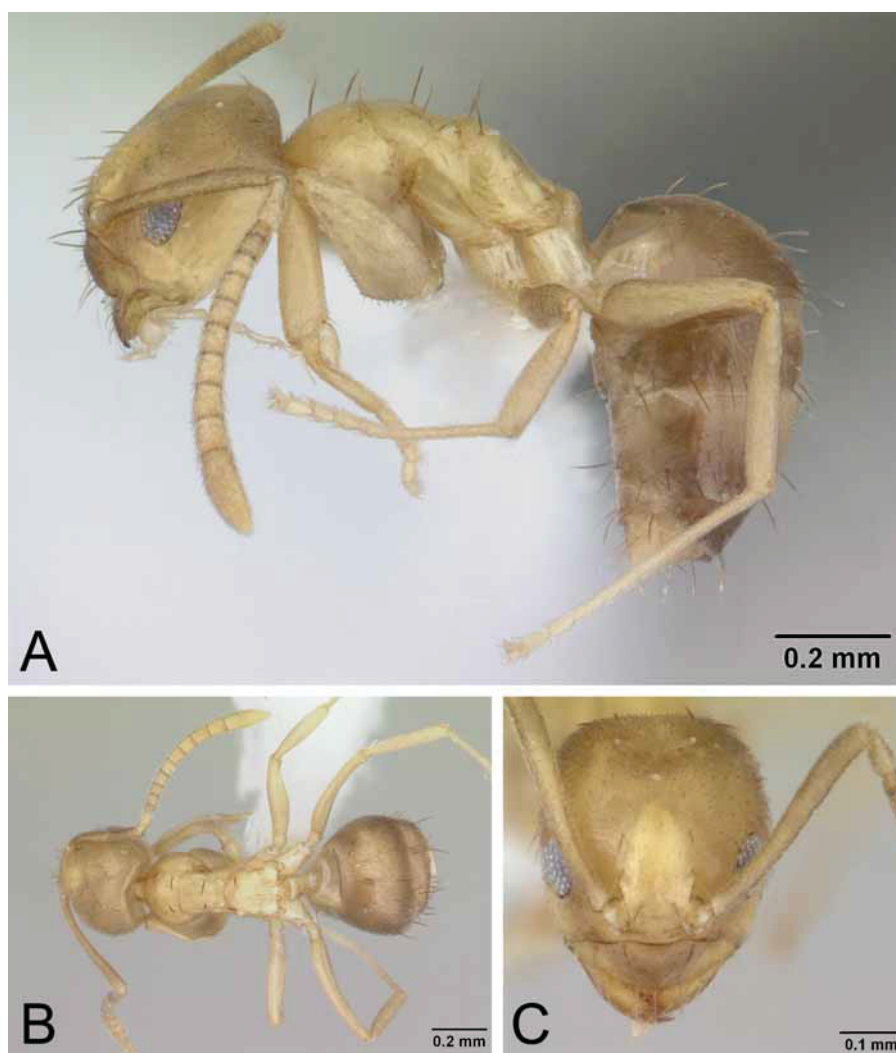


FIGURE 6. *Paraparatrechina oreias* worker holotype CASENT0178762. A, profile; B, dorsum; C, full face.

Head yellow, with darker segmental and mandibular margins; slightly longer than broad. A fine, short pubescence covers the head. Scapes surpass posterior margin by about the length of the first 2 funicular segments; scapes with appressed pubescence. Mesosoma compact, yellow to slightly brownish-yellow laterally; fine pubescence covers dorsum. Pronotum rises very steeply from anterior margin to dorsum. Mesonotal area distinct, with prominent mesonotal spiracles. Propodeum possesses a short, angular dorsal face, with a long declivitous face. Legs yellow, with trochanters sometimes whitish-yellow; gaster brownish-yellow becoming lighter yellow around segmental margins.

Etymology. The species epithet is a Greek noun in apposition for mountain nymph, in reference to the type locality on Mt. Cameroon.

Non-type material examined: CAMEROON: Prov. Sud-Ouest Mnt., Cameroon, 3.8 km 330° NNW Mapanja, 9° 9.1' E, 4° 6.5' S, 16.iv.2000, elev. 1440 m (B.L. Fisher)

Notes. The layer of appressed pubescence covering the head and scapes effectively separates this species from *P. subtilis*, the species most likely to be confused with *P. oreias*.

***Paraparatrechina splendida* LaPolla and Cheng, sp. nov.**

(Fig. 7, 16, 17)

Holotype worker, GABON: Prov. Ogooué-Maritime; Res. Monts Doudou; 24.3 km 307° NW Doussala; 2°13.4', 10°24.4'E; 6.iii.2000; elev. 375 m (B.L. Fisher #2170) (CASC); 6 paratype workers, same locality as holotype (CASC, USNM).

Worker diagnosis: body dark brown; mesosoma elongate (WL: 0.71–0.83); head distinctly longer than broad with long scapes; antennae and mandibles typically as dark brown as the head.



FIGURE 7. *Paraparatrechina splendida* worker holotype CASENT0178763. A, profile; B, dorsum; C, full face.

Compare with: *P. concinnata*

WORKER. *Measurements* ($n=8$): TL: 1.41–2.6; HW: 0.48–0.50; HL: 0.54–0.64; EL: 0.15–0.18; SL: 0.73–0.83; PW: 0.30–0.35; WL: 0.71–0.83; PDH: 0.30–0.34; PrFL: 0.58–0.63; PrFW: 0.14–0.19; GL: 0.74–1.26. *Indices*: CI: 76–86; REL: 25–30; SI: 157–172; FI: 24–31

Head dark brown (the darkest brown of any described Afrotropical *Paraparatrechina*); cuticular surface shining; head distinctly longer than broad. White and short pubescence covering head, with longer pubescence on clypeus although not as dense as on head. Mandibles dark brown to slightly lighter brown color than head. Scapes, dark brown to slightly lighter brown color than head, surpass the posterior margin by about the length of first 5 funicular segments; scapes with distinctly short pubescence. Pubescence covers entire mesosomal dorsum. Pronotum rise about 45° from anterior margin to dorsum; mesosoma elongate; dorsal face of propodeum gently rounded, with declivitous face of about the same length. Legs dark brown, but tarsi typically much lighter; tarsi typically become whiter towards the last tarsal segment in many specimens. Trochanters typically lighter brown than mesosoma; gaster dark brown as in the head and mesosoma, with white pubescence.

Etymology. The species epithet is a Latin adjective for splendid or gleaming, in reference to brilliant bluish-purple iridescence reflected on the cuticle of this species.

Non-type material examined: **GABON:** Prov. Ogooue-Maritime, Res. Monts Doudou, 24.3 km 307° NW Doussala, 10° 24.4' E, 2° 13.4' S, 6.iii.2000, elev. 375 m (B.L. Fisher); Prov. Ogooue-Maritime, Res. Monts Doudou, 24.3 km 307° NW Doussala, 10° 24.35' E, 2° 13.35' S, 5–12.iii.2000, elev. 370 m (S. van Noort); Prov. Ogooue-Maritime, Res. Monts Doudou, 25.2 km 304° NW Doussala, 10° 23.7' E, 2° 13.6' S, 14.iii.2000, elev. 640 m (B.L. Fisher); **UGANDA:** Ruwenzori Expedition, 10 ml. E.N.E. Bundibugyo, 26.viii.1952 (G.O. Evans)

Notes. This is the largest and darkest colored Afrotropical *Paraparatrechina*. This species may be confused with *P. concinnata*, but can be separated from that species based on the following differences: 1) color (*P. splendida* is a darker brown and the antennae, mandibles and coxae are the same color as the body, unlike in *P. concinnata*), 2) the length of the scape (*P. splendida* scape length is greater than 0.72 mm), and 3) longer profemora. The similarly shaped mesosomas of in *P. splendida* and *P. concinnata*, as well as their distinctly long heads, scapes, and femurs suggests that these two species are close relatives.

***Paraparatrechina subtilis* (Santschi, 1920)**

(Fig. 8, 16, 17)

Prenolepis (*Nylanderia*) *subtilis* Santschi, 1920: 174 (worker described). Holotypeworker, SENEGAL: Casamance (C. Paveau) (NHMB) [examined]. Emery, 1925: 218, combination in *Paratrechina* (*Nylanderia*); LaPolla *et al.*, 2010: 128, combination in *Paraparatrechina*.

Prenolepis (*Nylanderia*) *subtilis termitophila* Santschi, 1921: 122 (worker described). Holotype worker?, CAMEROON: Douala (von Rothkirch) (depository unknown, not in NHMB) [not examined]. Emery, 1925: 218, combination in *Paratrechina* (*Nylanderia*); LaPolla *et al.*, 2010: 128, combination in *Paraparatrechina*. **SYN. NOV.**

Worker diagnosis: metanotal area distinct, with raised metanotal spiracles; head and scapes with decumbent pubescence; cephalic pubescence longer lateroposteriorly.

Compare with: *P. oreias*

WORKER. *Measurements* ($n=10$): TL: 1.45–1.65; HW: 0.37–0.42; HL: 0.46–0.50; EL: 0.08–0.11; SL: 0.43–0.48; PW: 0.27–0.29; WL: 0.49–0.54; PDH: 0.22–0.25; PrFL: 0.35–0.39; PrFW: 0.1–0.11; GL: 0.46–0.7. *Indices*: CI: 77–87; REL: 17–22; SI: 110–122; FI: 25–32

Head yellow to light brown; cuticular surface shining. Short, decumbent pubescence covers head, especially lateroposteriorly, where it is longer than remainder of head. Scapes surpass posterior margin by about the length of the first funicular segment. Scapes covered in short, decumbent pubescence across their length. Mesosoma yellow to light brown and compact; fine pubescence covers entire mesosomal dorsum, although pubescence sparser on dorsal face of propodeum. Pronotum rises very steeply from anterior margin

to dorsum. Mesonotal area distinct, with prominent mesonotal spiracles. Dorsal face of propodeum short, gently rounded, with longer declivitous face. Legs same color as remainder of the body; gaster yellow, covered in a dense layer of pubescence.

Non-type material examined: **DEMOCRATIC REPUBLIC OF CONGO:** Epulu, 28° 35' E, 1° 23' N, xi.1995, elev. 750 m (S.D.Torti); **GABON:** Prov. Ogooue-Maritime, Res. Monts Doudou, 25.2 km 304° NW Doussala, 10° 23.67' E, 2° 13.63' S, 15.iii.2000, elev. 660 m (S. van Noort); **RWANDA:** Rangiro, i.1976, elev. 1800 m (P. Werner); Rangiro, ix.1976 (P. Werner)

Notes. This is a light colored species that can be distinguished by the presence of short, decumbent pubescence on the head and scapes, an uncommon character state for *Paraparatrechina* species. *P. umbranatis* also has decumbent pubescence on the head and scapes (although the pubescence is not as long), but can easily be distinguished from *P. subtilis* by the dark gaster contrasting with the lighter head and mesosoma. Unfortunately, type specimens of *P. subtilis termitophila* could not be located for this study (they were not found in NHMB by curator Daniel Burckhardt, pers. comm.). Based on the written description by Santschi (1921) there seems to be little to distinguish it from *P. subtilis*, thus our placement as a synonym.

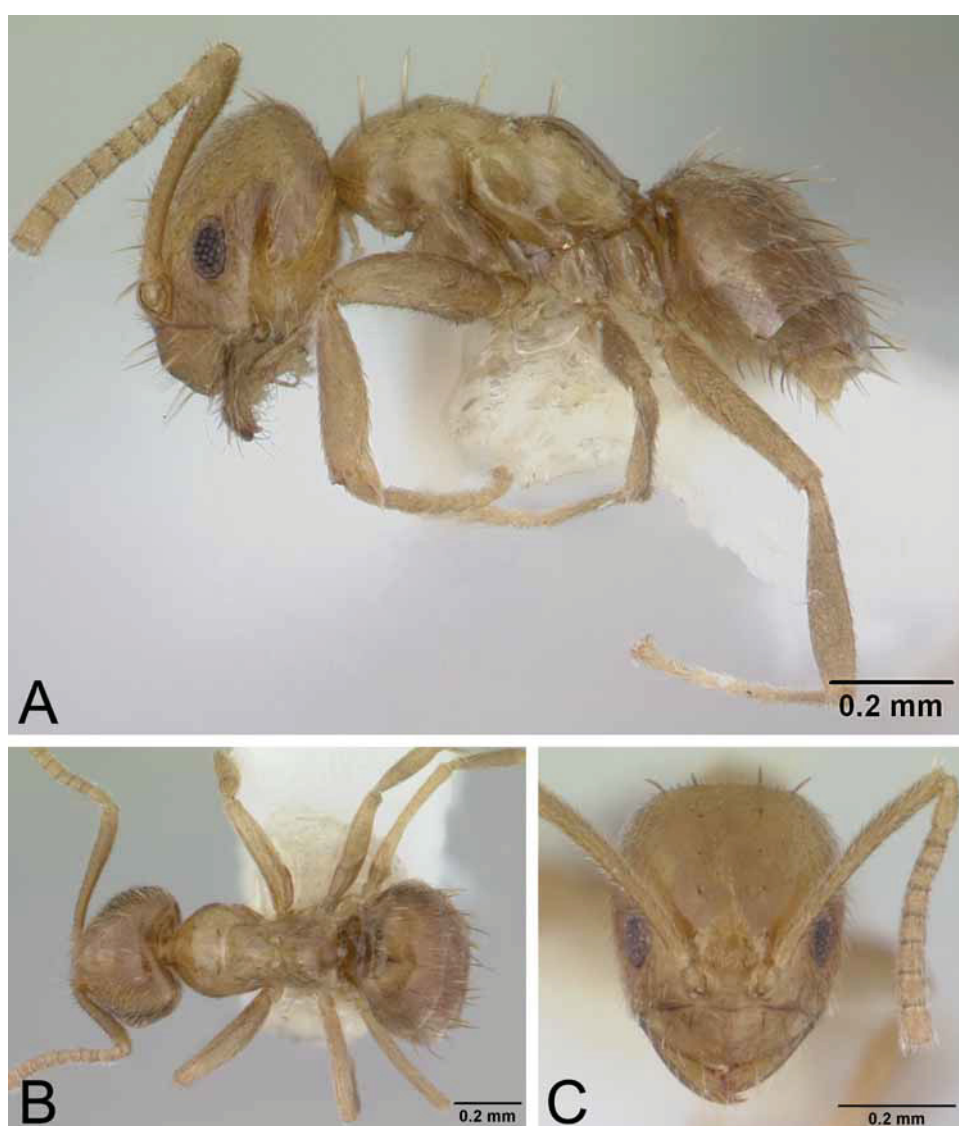


FIGURE 8. *Paraparatrechina subtilis* worker CASENT0178760. A, profile; B, dorsum; C, full face.

***Paraparatrechina umbranatis* LaPolla and Cheng, sp. nov.**

(Fig. 9, 16, 17)

Holotype worker, GABON: Prov. Ogooue-Martime; Res. Monts Doudou; 24.5 km 303° WNW Doussala; 2°14.0'S, 10°23.9'E; 18.iii.2000; elev. 630 m (B.L. Fisher #2276) (CASC); 8 paratype workers, same locality as holotype (CASC, USNM)

Worker diagnosis: body distinctly bicolored, with gaster much darker than head and mesosoma.

Compare with: *P. oreias* and *P. subtilis*

WORKER. Measurements ($n=12$): TL: 1.19–1.57; HW: 0.34–0.36; HL: 0.38–0.41; EL: 0.098–0.112; SL: 0.38–0.43; PW: 0.21–0.27; WL: 0.42–0.49; PDH: 0.18–0.23; PrFL: 0.31–0.34; PrFW: 0.098–0.112; GL: 0.39–0.7. **Indices:** CI: 87–92; REL: 25–29; SI: 108–120; FI: 30–36

Head yellowish-brown to light brown, with antennae mandibles, and medial area between antennae slightly lighter; head slightly longer than broad. A dense layer of fine, short, slightly decumbent pubescence covers head. Scapes surpass posterior margin by about the length of the first funicular segment; scape with a dense, slightly decumbent pubescence. Mesosoma yellowish-brown to light brown; fine pubescence covers entire mesosomal dorsum; lateral portions of the mesosoma are distinctly shinier than the dorsum. Pronotum rises steeply from anterior margin to dorsum. Propodeum possesses a short, angular dorsal face, with a long declivitous face. Legs generally lighter colored than mesosoma, becoming whitish towards last tarsal segments. Procoxae usually darker brown than meso/metacoxae; gaster conspicuously darker than head and mesosoma and is covered in a dense layer of pubescence.



FIGURE 9. *Paraparatrechina umbranatis* worker holotype CASENT0178764. A, profile; B, dorsum; C, full face.

Etymology. The species epithet is a Latin noun in apposition, a compound of umbra (=shade) and natis (=rump), in reference to the fact that the gaster is much darker in color than the head and mesosoma.

Non-type material examined: **ANGOLA:** Salazar, 9–15.iii.1972 (P.M. Hammond); **GABON:** Prov. Ogooue-Maritime, Res. Monts Doudou, 25.2 km 304° NW Doussala, 10° 23.7' E, 2° 13.6' S, 14.iii.2000, elev. 640 m (B.L. Fisher); Prov. Ogooue-Maritime, Res. Monts Doudou, 24.5 km 303° WNW Doussala, 10° 23.9' E, 2° 14.0' S, 18.iii.2000, elev. 630 m (B.L. Fisher); Prov. Ogooue-Maritime, Reserve de la Moukalaba-Dougoua, 7km NW Doussala, 10° 32.65' E, 2° 19.84' S, 21.iii.2000, elev. 110 m (S. van Noort); **KENYA:** Buyangu Nature Reserve, 0.37° N, 34.87° E (R. Snelling & A. Espira).

Notes. This species is easily recognizable by the distinctly darker gaster (brown) contrasting with the yellow-brown head and mesosoma. While many *Paraparatrechina* species display various coloration patterns between the different tagmata this is the only species that could be considered truly bicolored.

Malagasy Species

Paraparatrechina glabra (Forel, 1891)

(Figs. 10, 11, 15F–J, 16, 17)

Prenolepis glabra, Forel, 1891: 92 (worker described). 3 syntype workers examined, MADAGASCAR (MHNG).

Emery, 1914: 422, combination in *Prenolepis* (*Nylanderia*); Emery, 1925: 219, combination in *Paratrechina* (*Nylanderia*); LaPolla *et al.*, 2010: 128, combination in *Paraparatrechina*.

Worker diagnosis: elongate mesosoma (WL: 0.4–0.6), with pronotum rise of about 45° from anterior margin to dorsum; REL ≥ 20.

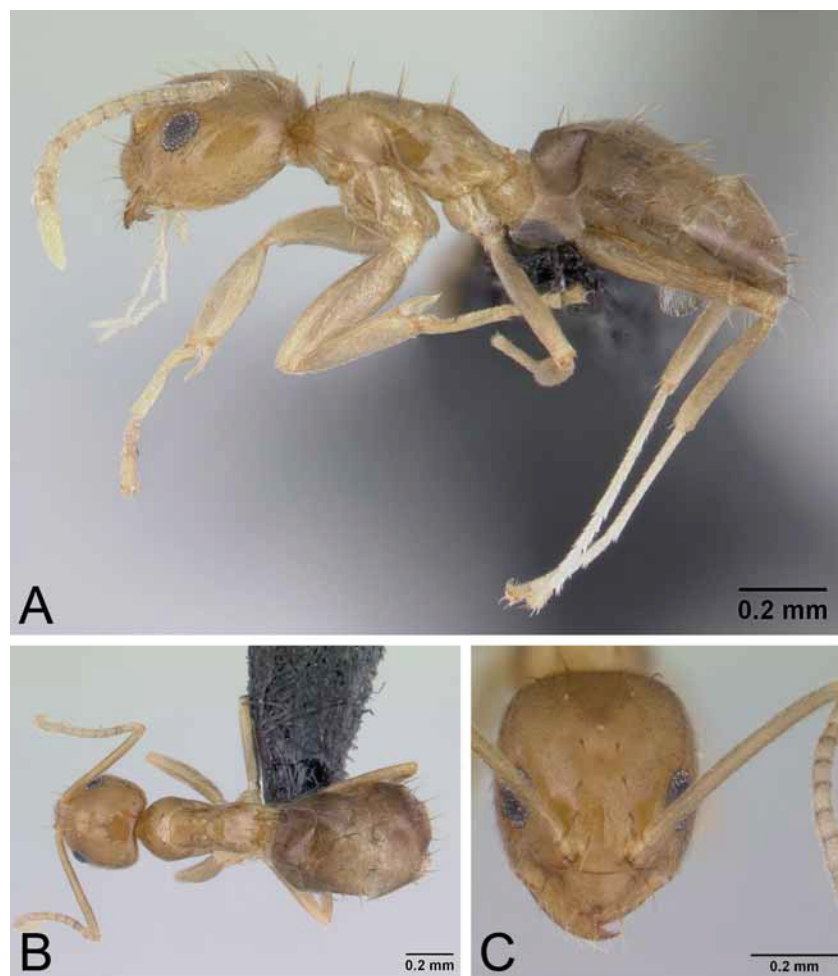


FIGURE 10. *Paraparatrechina glabra* worker CASENT0489221. A, profile; B, dorsum; C, full face.

Compare with: *P. myops* and *P. ocellatula*

WORKER. *Measurements* ($n=39$): TL: 1.38–2.22; HW: 0.35–0.48; HL: 0.41–0.58; EL: 0.1–0.129; SL: 0.47–0.64; PW: 0.25–0.33; WL: 0.44–0.66; PDH: 0.21–0.28; PrFL: 0.35–0.48; PrFW: 0.1–0.134; GL: 0.476–0.91. *Indices*: CI: 75–102; REL: 20–26; SI: 104–140; FI: 24–36

Head brownish-yellow to yellowish-brown, with darker segmental and mandibular margins; head slightly longer than broad. Head pubescence variable from appressed to suberect, with a shining cuticular surface. Scapes surpass posterior margin by about the length of the first 4 funicular segments; scapes with appressed pubescence. Mesosoma brownish-yellow to yellowish-brown and elongate; fine, appressed pubescence covers entire mesosomal dorsum. Pronotum rises about 45° from anterior margin to dorsum; propodeum possesses a short, angular dorsal face with a long declivitous face. Legs are often lighter in color than the mesosoma, with the trochanters and tarsi often whitish-yellow. The gaster is similarly colored as head and mesosoma.

QUEEN. *Measurements* ($n=1$): TL: 5.09; HW: 1.0; HL: 0.94; EL: 0.29; SL: 0.97; PW: 1.09; WL: 1.79; PDH: 0.58; PrFL: 0.88; PrFW: 0.27; GL: 2.36. *Indices*: CI: 108; REL: 28; SI: 96; FI: 30

As in worker, with modifications expected for caste. Pubescence very dense, extending from dorsum to lateral regions of the mesosoma.

MALE. *Measurements* ($n=3$): TL: 2.1–2.28; HW (including eyes): 0.52–0.53; HL: 0.45–0.47; EL: 0.2–0.22; SL: 0.33–0.34; PW: 0.38–0.38; WL: 0.69–0.71; PrFL: 0.52–0.56; PrFW: 0.11–0.12; GL (including parameres): 0.94–1.1. *Indices*: CI: 112–115; REL: 44–46; SI: 63; FI: 6–21

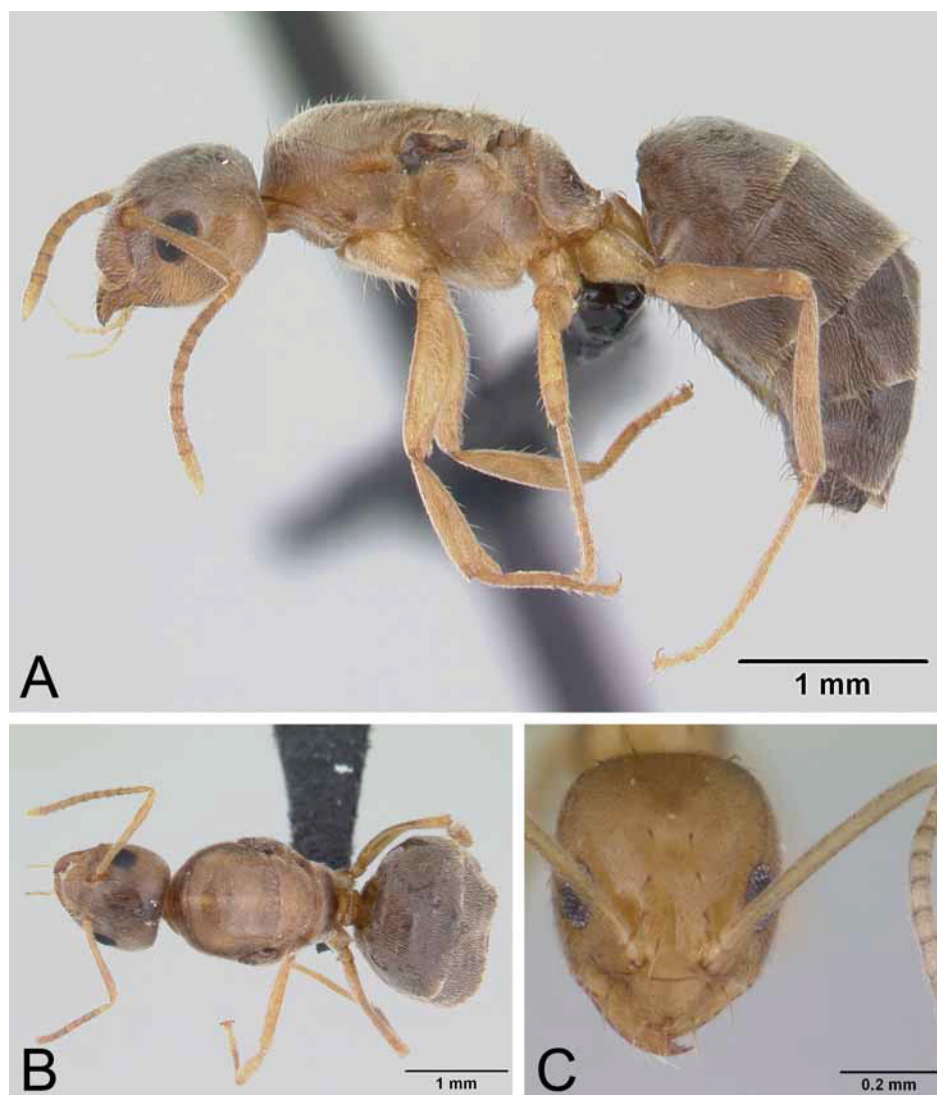


FIGURE 11. *Parapatrechina glabra* queen CASENT0021681. A, profile; B, dorsum; C, full face.

Head dark brown, with bulging large eyes that occupy most of the lateral region of the head; three prominent ocelli present. Head slightly broader than long. Palps distinctly lighter than head in color. A dense layer of pubescence covers head. Scapes surpass posterior margin by less than half of the length of the first funicular segment; scapes are slightly lighter in color than surrounding head. Antennae 13-segmented. Mandible with apical tooth and indistinct basal angle. Mesosoma dark brown as in head; pronotum short and collar-like; mesonotum large, rounded anteriorly, overarched pronotum; mesosoma dorsum flat, with suberect setae. Declivity indistinct from propodeum; propodeum lower than mesonotum and scutellum. Gaster dark brown, covered with pubescence and scattered erect setae. Parameres elongate, with scattered erect setae, especially towards apices.

Non-type material examined: MADAGASCAR: Prov. Antananarivo, 3 km 410 NE Andranomay 11.5 km 147° SSE Anjozorobe, 47° 58' E, 18° 28' S, 5–13.xii.2000, elev. 1300 m (Fisher *et al.*); Prov. Antananarivo, Res. Ambohitantely, 20.9 km 72° NE Ankazobe, 47° 17' E, 18° 14' S, 17–22.iv.2001, elev. 1410 m (Rabeson *et al.*); Prov. Antananarivo, Res. Ambohitantely, 24.1 km 59° NE Ankazobe, 47° 17' E, 18° 10' S, 17–22.iv.2001, elev. 1620 m (Rabeson *et al.*); Prov. Antsiranana, Ambilanivy, 3.9 km 181° S Apasidava, 48° 10' E, 13° 48' S, 4–9.iii.2001, elev. 600 m (Fisher *et al.*); Prov. Antsiranana, Ampasindava, Ambilanivy, 3.9 km 181° S Ambaliha, 48° 10' E, 13° 48' S, 4–9.iii.2001, elev. 600 m (Fisher *et al.*); Prov. Antsiranana, For t Andavakoera, 21.4 km 75° ENE Ambilobe, 49° 33.8' E, 13° 7.1' S, 15–17.xii.2003, elev. 425 m (Fisher *et al.*); Prov. Antsiranana, For t Antsahabe, 11.4 km 275° W Daraina, 49° 33.4' E, 13° 7.7' S, 12–14.xii.2003, elev. 550 m (Fisher *et al.*); Prov. Antsiranana, Foret Ambanitaza, 26.1 km 347° Antalaha, 50° 11.2' E, 14° 40.76' S, 25–28.xi.2004, elev. 240 m (B.L. Fisher); Prov. Antsiranana, Foret Binara, 9.4 km 235° SW Daraina, 49° 36.0' E, 13° 16.8' S, 5–6.xii.2003, elev. 1100 m (Fisher *et al.*); Prov. Antsiranana, Foret Binara, 9.1 km 233° SW Daraina, 49° 36.2' E, 13° 15.8' S, 3–7.xii.2003, elev. 650–800 m (Fisher *et al.*); Prov. Antsiranana, PN Marojejy, 28 km 38° NE Andapa, 49° 46.5' E, 14° 26.2' S, 12–15.xi.2003, elev. 450 m (Fisher *et al.*); Prov. Antsiranana, PN Marojejy, 27.6 km 35° NE Andapa, 49° 45.6' E, 14° 26.1' S, 15–18.xi.2003, elev. 775 m (Fisher *et al.*); Prov. Antsiranana, PN Marojejy, 26.6 km 31° NE Andapa, 49° 44.6' E, 14° 26.2' S, 18–21.xi.2003, elev. 1325 m (Fisher *et al.*); Prov. Antsiranana, RNI Marojejy, 8 km NW Manantenina, 49° 47' E, 14° 26' S, 5–13.x.1996, elev. 450 m (E.L. Quinter); Prov. Antsiranana, RS Manongaivo, 12.8 km 228° SW Antanambao, 48° 25.4' E, 13° 58.6' S, 11.x.1998, elev. 780 m (B.L. Fisher); Prov. Antsiranana, RS Manongaivo, 14.5 km 220° SW Antanambao, 48° 25.7' E, 13° 59.9' S, 20.x.1998, elev. 1175 m (B.L. Fisher); Prov. Antsiranana, RS Manongaivo, 10.8 km 229° SW Antanambao, 48° 26.0' E, 13° 57.7' S, 8.xi.1998, elev. 400 m (B.L. Fisher); Prov. Antsiranana, PN Montagne Ambre, 3.6 km 235° SW Joffreville, 49° 11' E, 12° 32' S, 20–26.i.2001, elev. 925 m (Fisher *et al.*); Prov. Antsiranana, PN Montagne Ambre, 12.2 km 211° SSW Joffreville, 49° 10' E, 12° 36' S, 2–7.ii.2001, elev. 1300 m (Fisher *et al.*); Prov. Antsiranana, PN Montagne Ambre, 12.2 km 211° SSW Joffreville, 49° 10' E, 12° 36' S, 7.ii.2001, elev. 1300 m (Fisher *et al.*); Prov. Antsiranana, PN Montagne d' Ambre, 49° 10.53' E, 12° 30.52' S, 11–12.ii.2001, elev. 960 m (E.R. Harin'Hala); Prov. Antsiranana, PN Montagne d' Ambre, 12.2 km 211° SSW Joffreville, 49° 10.53' E, 12° 30.52' S, 5–21.iv.2001, elev. 960 m (E.R. Harin'Hala); Prov. Antsiranana, PN Montagne d' Ambre, 49° 10.45' E, 12° 31.13' S, 26.iv.2001–12.v.2001, elev. 1125 m (E.R. Harin'Hala); Prov. Antsiranana, PN Montagne d' Ambre, 49° 10.53' E, 12° 30.52' S, 26–29.i.2001, elev. 960 m (E. Schlinger); Prov. Antsiranana, Nosy Be, Res Lokobe, 6.3 km 112° ESE Hellville, 48° 20' E, 3° 25' S, 19–24.iii.2001, elev. 30 m (Fisher *et al.*); Prov. Antsiranana, Nosy Be, Res. Lokobe, 6.3 km 112° ESE Hellville, 48° 20' E, 13° 25' S, 19–24.iii.2001, elev. 30 m (Fisher *et al.*); Prov. Fianarantsoa, 8 km NE Ivohibe, 46° 53.9' E, 22° 25.3' S, 3–9.xi.1997, elev. 1200 m (B.L. Fisher); Prov. Fianarantsoa, 9 km Ne Ivohibe, 46° 56.3' E, 22° 25.6' S, 12–17.xi.1997, elev. 900 m (B.L. Fisher); Prov. Fianarantsoa, Mahabo, 47° 43.38' E, 23° 11.63' S, 19.iv.2006, elev. 20 m (Fisher *et al.*); Prov. Fianarantsoa, Manombo, 47° 43.14' E, 23° 0.95' S, 20.iv.2006, elev. 30 m (Fisher *et al.*); Prov. Fianarantsoa, PN Ranomafana, 47° 24.43' E, 21° 15.5' S, 21.i.2002, elev. 1130 m (E.R. Harin'Hala); Prov. Fianarantsoa, Vatovavy, 47° 56.4' E, 21° 24.0' S, 6–8.vi.2005, elev. 175 m (Fisher *et al.*); Prov. Fianarantsoa, Vevembe, 47° 10.91' E, 22° 47.46' S, 23–24.iv.2006, elev. 600 m (Fisher *et al.*); Prov. Toamasina, Ambohidena, 49° 57.85' E, 16° 49.46' S, 21–24.vi.2005, elev. 20 m (Fisher *et al.*); Prov. Toamasina Prov. Toamasina, Ambohidena, 49° 57.85' E, 16° 49.46' S, 21–24.xi.2005, elev. 20 m (Fisher *et*

al.); Prov. Toamasina, Ambodiriana, 49° 42.7' E, 16° 40.34' S, 18.xii.2005, elev. 125 m (Fisher *et al.*); Prov. Toamasina, Analalava, 49° 27.24' E, 17° 42.57' S, 27.xi.2005, elev. 50 m (Fisher *et al.*); Prov. Toamasina, Betampona, 49° 11.98' E, 17° 55.44' S, 28.xi.2005, elev. 390 m (Fisher *et al.*); Prov. Toamasina, Betampona, 49° 12.15' E, 17° 53.20' S, 17.xii.2005, elev. 520 m (Fisher *et al.*); Prov. Toamasina, For t Tampolo, Parcelle E3, 10 km NE Fenerive-Est., 49° 26' E, 17° 17' S, 14–15.iv.2004, elev. 10 m (Fisher *et al.*); Prov. Toamasina, For t Tampolo, Parcelle K7, 10 km NE Fenerive-Est., 49° 25' E, 17° 17' S, 16–17.iv.2004, elev. 10 m (Fisher *et al.*); Prov. Toamasina, For t Tampolo, Parcelle K9, 10 km NE Fenerive-Est., 49° 26.8' E, 17° 17.5' S, 19–20.iv.2004, elev. 10 m (Fisher *et al.*); Prov. Toamasina, For t Torotorofotsy, 14.9 km 71° ENE Moramanga, 48° 20.8' E, 18° 52.2' S, 24–29.iii.2004, elev. 1050 m (Fisher *et al.*); Prov. Toamasina, Foret Ambatovy, 14.3 km 57° NE Moramanga, 48° 19.2' E, 18° 51.5' S, 19–23.iii.2004, elev. 1075 m (Fisher *et al.*); Prov. Toamasina, F. C. Andriantantely, 48° 48.8' E, 18° 41.7' S, 7–10.xii.1998, elev. 530 m (H. J. Ratsirarson); Prov. Toamasina, F.C. Sandrnanitra, 49° 5.5' E, 18° 2.9' S, 18–21.i.1998, elev. 450 m (H. J. Ratsirarson); Prov. Toamasina, Kalalao, 49° 53.24' E, 16° 55.35' S, 24–27.xi.2005, elev. 100 m (Fisher *et al.*); Prov. Toamasina, Mahavelona (Foulpointe), 49° 30.0' E, 17° 40.0' S, 11–17.xii.1993 (A. Pauly); Prov. Toamasina, Mont. Akirindro, 7.6 km 341° NNW Ambinanitelo, 49° 32.9' E, 15° 17.3' S, 17–21.iii.2003, elev. 600 m (Fisher *et al.*); Prov. Toamasina, Mont. Anjanaharibe, 18 km 21° NNE Ambinanitelo, 49° 36.9' E, 15° 11.3' S, 8–12.iii.2003, elev. 470 m (Fisher *et al.*); Prov. Toamasina, Mont. Anjanaharibe, 19.5 km 27° NNE Ambinanitelo, 49° 38.1' E, 15° 10.7' S, 12–16.iii.2003, elev. 1100 m (Fisher *et al.*); Prov. Toamasina, PN Mananara-Nord, 49° 47.25' E, 16° 27.3' S, 14.xi.2005, elev. 225 m (Fisher *et al.*); Prov. Toamasina, Mandrisky, 49° 50.82' E, 16° 29.14' S, 11–14.xi.2005, elev. 10 m (Fisher *et al.*); Prov. Toamasina, PN Mantadia, 48° 25.6' E, 18° 47.5' S, 25–28.xi.1998–28–1.xii.1998, elev. 895 m (H. J. Ratsirarson); Prov. Toamasina, SF Tampolo, 10 km NNE Fenoarivo Atn., 49° 25' E, 17° 17' S, 6.iv.1997, elev. 10 m (B.L. Fisher); Prov. Toliara, 2.7 km WNW 302° Ste. Luce, 47° 10.3' E, 24° 46.3' S, 9–11.xii.1998, elev. 20 m (B.L. Fisher); Prov. Toliara, PN Ambohijanahary, 35.2 km 312° NW Ambaravarana, 45° 24.4' E, 18° 16.0' S, 13–17.i.2003, elev. 1050 m (Fisher *et al.*); Prov. Toliara, PN Ambohijanahary, 34.6 km 314° NW Ambaravarana, 45° 25.1' E, 18° 15.6' S, 16.i.2003, elev. 1100 m (Fisher *et al.*); Prov. Toliara, Ambohijanahary, 35.2 km 312° NW Ambaravarana, 45° 24.4' E, 18° 16.0' S, 13–17.i.2003, elev. 1050 m (Fisher *et al.*); Prov. Toliara, Andohahela, Manampanihy, 5.4 km 113° ESE Mahamavo, 46° 46' E, 24° 46' S, 24.i.2002, elev. 650 m (Fisher *et al.*); Prov. Toliara, PN Andohahela, 3.8 km 113° ESE Mahamavo, 46° 45' E, 24° 46' S, 21–25.i.2002, elev. 900 m (Fisher *et al.*); Prov. Toliara, Foret de Petriky, 12.5 km 272° W Tolagnaro, 46° 52.2' E, 25° 3.7' S, 22.xi.1998, elev. 10 m (B.L. Fisher); Prov. Toliara, SF Mandena, 8.4 km 30° NNE Tolagnaro, 47° 0.1' E, 24° 57.1' S, 20.xi.1998, elev. 20 m (B.L. Fisher); 45 km S Ambalavao, 47° 1' E, 22° 13' S, 25.ix.1993, elev. 785 m (B.L. Fisher); Ambanizana, 6.9 km NE, 50° 0' E, 15° 34' S, 8.xii.1993, elev. 825 m (B.L. Fisher); Ambanizana, 6.9 km NE, 50° 0' E, 15° 34' S, 8.xii.1993, elev. 1000 m (B.L. Fisher); 6.9 km NE Ambanizana, 50° 0' E, 15° 34' S, 9.xii.1993, elev. 825 m (B.L. Fisher); Res. Andohahela, 11 km NW Enakara, 46° 49' E, 24° 34' S, 17.vi.1992, elev. 800 m (B.L. Fisher); Res. Andohahela, 10 km NW Enakara, 46° 49' E, 24° 34' S, 24.xi.1992, elev. 430 m (B.L. Fisher); Res. Andohahela, 13 km NW Enakara, 46° 48' E, 24° 33' S, 30.xi.1992, elev. 1250 m (B.L. Fisher); Andranobe, 5.3 km SSE Ambanizana, 49° 58' E, 15° 40' S, 23.xi.1993, elev. 425 m (B.L. Fisher); Res. Anjanaharibe-Sud, 6.5 km SSW Befingotra, 49° 30' E, 14° 45' S, 19.x.1994, elev. 875 m (B.L. Fisher); Res. Anjanaharibe-Sud, 6.5 km SSW Befingotra, 49° 30' E, 14° 45' S, 28.x.1994, elev. 875 m (B.L. Fisher); Res. Anjanaharibe-Sud, 9.2 km WSW Befingotra, 49° 28' E, 14° 45' S, 10.xi.1994, elev. 1200 m (B.L. Fisher); Res. Anjanaharibe-Sud, 9.2 km WSW Befingotra, 49° 28' E, 14° 45' S, 12–13.xi.1994, elev. 1280 m (B.L. Fisher); PN Ranomafana, Vatoharanana, 4.1 km 231° SW Ranomafana, 47° 26.0' E, 21° 17.4' S, 27–31.iii.2003, elev. 1100 m (Fisher *et al.*)

Notes. Due to the range of sizes observed in workers, we ran a PCA (principal components analysis) using a correlation matrix including the following variables: HW, HL, SL, and WL to determine whether or not cryptic species could be detected with quantitative morphological data. Only the first principal component (PC) axis was significant and it explained 94% of variation in the data. The second PC axis explained 2.6% of variability in the data and was not significant. PC 1 reflected overall variation in worker body size: all of the original variables were highly correlated with PC 1 ($r \geq 0.05$). Low PC scores were correlated with large body measurements. Conversely, large PC scores were correlated with small body measurements.

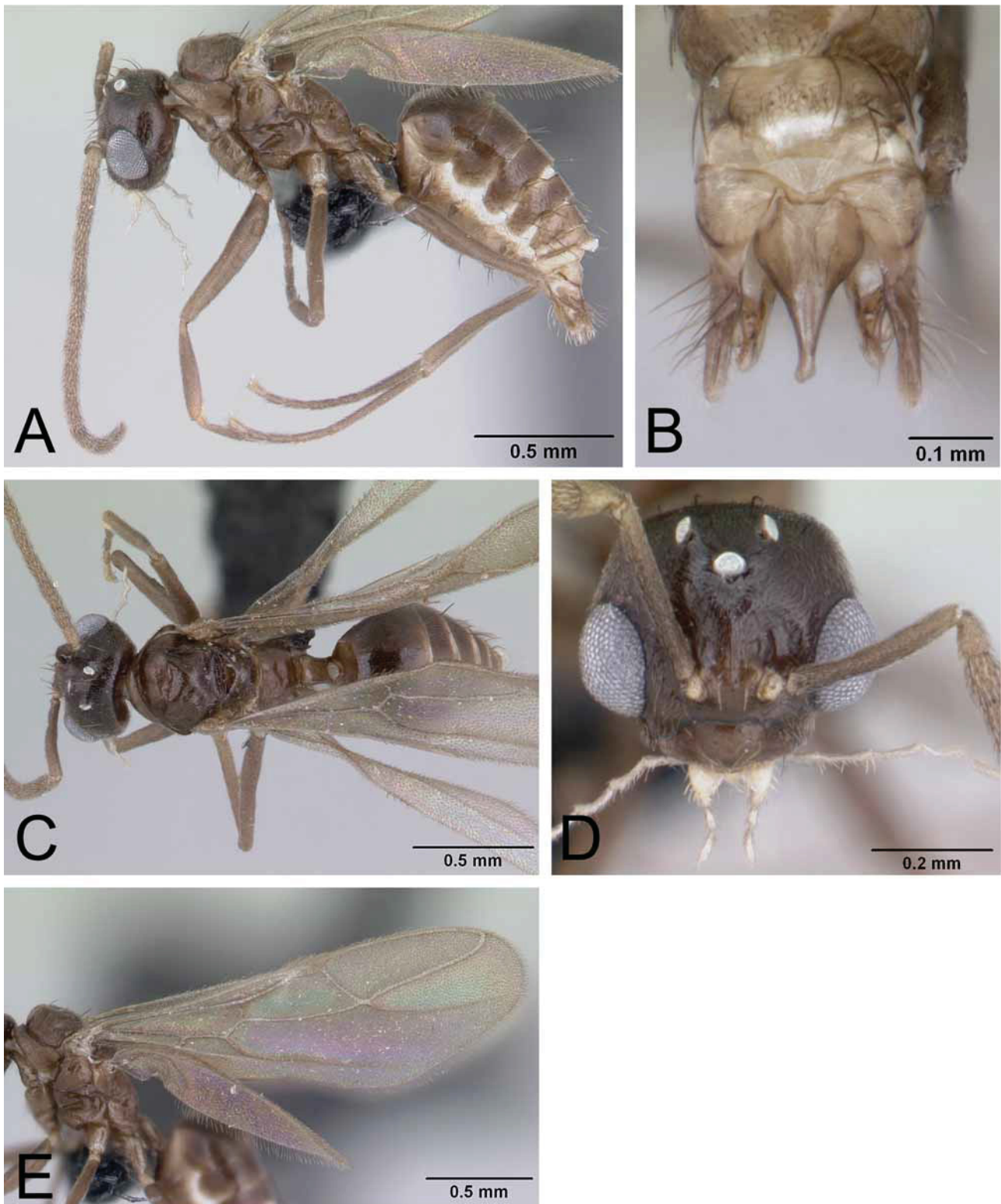


FIGURE 12. *Paraparatrechina glabra* male CASENT0497708. A, profile; B, genitalia in dorsal view; C, dorsum; D, full face; E, hindwing and forewing.

Linear regression showed that PC 1 scores (i.e., body size) were significantly related to elevation of sample site ($R^2 = 43\%$, $p < 0.0001$). Small ants were collected at low elevations and larger ants were collected at higher elevations. Therefore, we interpret the morphological size variation observed in *P. glabra* as clinal variation. It would be instructive to test this hypothesis with molecular data in future analyses.

Workers of this species are easily distinguished from the other Malagasy *Paraparatrechina* by the presence of large eyes.

***Paraparatrechina myops* LaPolla and Fisher, sp. nov.**

(Fig. 13, 16, 17)

Holotype worker, MADAGASCAR: Prov. Antsiranana; P.N. Marojejy; 26.6 km 31° NNE Andapa; 18–21.xi.2003; elev. 1325 m; 14°26.2' S, 49°44.6'E; Fisher *et al.* (BLF 9080) (CASC); 6 paratype workers, same locality as holotype (CASC, USNM)

Worker diagnosis: small eyes (REL: <20); scapes with decumbent pubescence.

Compare with: *P. glabra* and *ocellatula*

WORKER. Measurements ($n=27$): TL: 1.8–2.4; HW: 0.42–0.51; HL: 0.51–0.64; EL: 0.07–0.11; SL: 0.55–0.74; PW: 0.31–0.36; WL: 0.56–0.78; PDH: 0.21–0.3; PrFL: 0.43–0.62; PrFW: 0.1–0.14; GL: 0.61–1.05. **Indices:** CI: 77–89; REL: 13–17; SI: 121–162; FI: 20–25

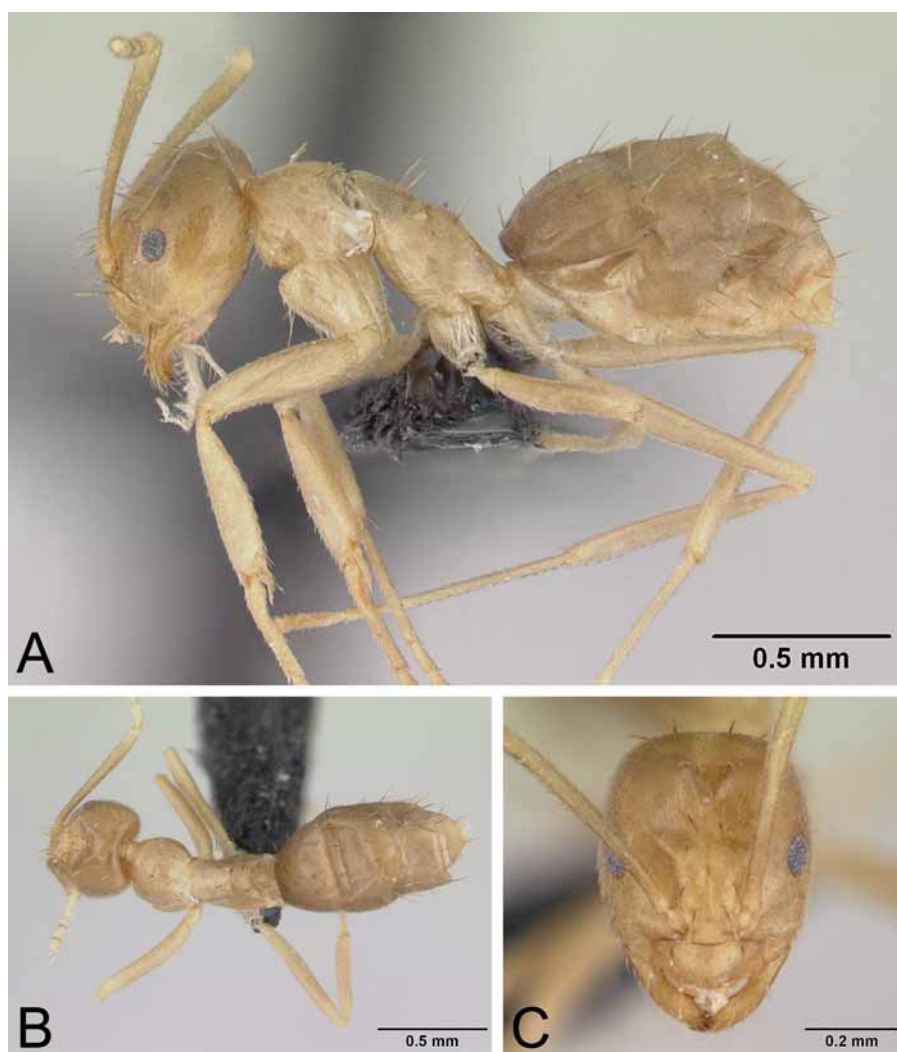


FIGURE 13. *Paraparatrechina myops* worker holotype CASENT0042527. A, profile; B, dorsum; C, full face.

Head yellow, with slightly lighter yellow antennae; cuticular surface shining. Pubescence covering head appressed, but long, giving it a shaggy appearance. Scapes surpass posterior margin by about the length of the first 3–4 funicular segments; scapes covered in short, decumbent pubescence. Mesosoma yellow and compact; a fine pubescence covers entire mesosomal dorsum. Metanotal area distinct, with prominent mesonotal spiracles. Pronotum rises steeply from anterior margin to dorsum. Propodeum possesses a short, slightly rounded dorsal face, with a long declivitous face. Legs yellow and in some specimens the trochanters and tarsi are slightly lighter yellow; gaster yellow.

Etymology. The species epithet is a Greek noun in apposition for mouse eye, in reference to the small eyes found in this species.

Non-type material examined: MADAGASCAR: Prov. Antsiranana, R.S. Manongarivo, 14.5 km 220° SW Antanambao, 48° 25.7' E, 13° 59.9' S, 20.x.1998, elev. 1175 m (B.L. Fisher); Prov. Antsiranana, P.N. Marojejy, 26.6 km 31° NNE Andapa, 49° 44.6' E, 14° 26.2' S, 18–21.xi.2003, elev. 1325 m (Fisher *et al.*); 9.2 km WSW Befingotra, Res. Anjanaharibe-Sud, 49° 28' E, 14° 45' S, 5.xi.1994, elev. 1280 m (B.L. Fisher); 6.5 km SSW Befingotra, Res. Anjanaharibe-Sud, 49° 30' E, 14° 45' S, 19.x.1994, elev. 875 m (B.L. Fisher); 9.2 km WSW Befingotra, Res. Anjanaharibe-Sud, 49° 28' E, 14° 15' S, 9.xi.1994, elev. 1200 m (B.L. Fisher); 11 km WSW Befingotra, Res. Anjanaharibe-Sud, 49° 27' E, 14° 45' S, 16.xi.1994, elev. 1565 m (B.L. Fisher)

Notes. There are two species of Malagasy *Paraparatrechina* that possess small eyes, *P. myops* and *P. ocellatula*. Interestingly, both appear to be montane species. These two species are difficult to separate, their main distinguishing feature being the different sizes of various anatomical structures. *P. myops* is a much larger species and also possesses decumbent pubescence on the scapes; *P. ocellatula* is a smaller species overall, and possesses appressed pubescence on the scapes. Given the propensity of *Prenolepis* genus-group species to evolve worker polymorphism (LaPolla *et al.*, 2010), we at first considered *P. myops* to be larger workers of *P. ocellatula*. However, plots of their corresponding morphological data clearly indicate the presence of two groups (fig. 16E) rather than continuous variation. As a result, we have chosen to consider these two groups as distinct species based on their significant morphometric differences, but as molecular and other forms of data become available the specific status of both *P. myops* and *P. ocellatula* should be reexamined.

***Paraparatrechina ocellatula* LaPolla and Fisher, sp. nov.**

(Fig. 14, 16, 17)

Holotype worker, MADAGASCAR: Prov. Antananarivo; R.S. Ivohibe; 6.5 km ESE Ivohibe; elev. 1575; 22°29.8'S, 46°57.3'E; 24–30.x.1997; (B.L. Fisher #1751) (CASC); 8 paratypes, same locality as holotype (CASC, USNM)

Worker diagnosis: Small eyes (REL <20); scapes with appressed pubescence.

Compare with: *P. glabra* and *P. myops*

WORKER. Measurements ($n=56$): TL: 1.42–2.1; HW: 0.39–0.48; HL: 0.43–0.6; EL: 0.06–0.09; SL: 0.43–0.55; PW: 0.25–0.33; WL: 0.45–0.6; PDH: 0.18–0.26; PrFL: 0.34–0.66; PrFW: 0.09–0.13; GL: 0.45–0.95. **Indices:** CI: 77–91; REL: 11–15; SI: 102–128; FI: 18–33

Overall worker of *P. ocellatula* matches the description of *P. myops* with the following differences: 1) Overall measurements generally smaller, especially when considering morphometric comparisons (see above measurements and figures 16E); 2) scapes with appressed pubescence, compared with the more decumbent pubescence on the scapes of *P. ocellatula*; 3) scapes surpass posterior margin by about the length of the first 2–3 funicular segments.

Etymology. The species epithet is a Latin double diminutive, adjectival in form, for meaning very small-eyed, in reference to the small eyes found in this species.

Non-type material examined: MADAGASCAR: Prov. Antananarivo, 3 km 41° NE Andranomay, 11.5 km 1470 SSE Anjozorobe, 47° 58' E, 18° 28' S, 5–13.xii.2000, elev. 1300 m (Fisher *et al.*); Prov. Antsiranana, R.S. Manongarivo, 14.5 km 220° SW Antanambao, 48° 25.7' E, 13° 59.9' S, 20.x.1998, elev. 1175 m (B.L. Fisher); Prov. Antsiranana, P.N. Marojejy, 27.6 km 35° NE Andapa, 49° 45.6' E, 14° 26.1' S,

15–18.xi.2003, elev. 775 m (Fisher *et al.*); Prov. Antsiranana, P.N. Marojejy, 26.6 km 31° NNE Andapa, 49° 44.6' E, 14° 26.2' S, 18–21.xi.2003, elev. 1325 m (Fisher *et al.*); Prov. Fianarantsoa, 2 km W Andrambovato, 47° 24.6' E, 21° 30.7' S, 3–5.vi.2005, elev. 1075 m (Fisher *et al.*); Prov. Fianarantsoa, R.S. Ivohibe, 7.5 km ENE Ivohibe, 46° 57.6' E, 22° 28.2' S, 7–12.x.1997, elev. 900 m (B.L. Fisher); Prov. Fianarantsoa, R.S. Ivohibe, 8 km E Ivohibe, 46° 58.1' E, 22° 29.0' S, 15–21.x.1997, elev. 1200 m (B.L. Fisher); Prov. Fianarantsoa, R.S. Ivohibe, 6.5 km ESE Ivohibe, 46° 57.3' E, 22° 29.8' S, 24–30.x.1997, elev. 1575 m (B.L. Fisher); Prov. Fianarantsoa, 8 km NE Ivohibe, 46° 53.9' E, 22° 25.3' S, 3–9.xi.1997, elev. 1200 m (B.L. Fisher); Prov. Fianarantsoa, Vevembe, 47° 10.91' E, 22° 47.46' S, 23.iv.2006, elev. 600 m (Fisher *et al.*); Prov. Toamasina, For t Analamay, 19.1 km 51° NE, Moramanga, 48° 20.2' E, 18° 48.3' S, 19–23.iii.2004, elev. 1068 m (Fisher *et al.*); Prov. Toamasina, Foret Ambatovy, 14.3 km 57° NE Moramanga, 48° 12.2' E, 18° 51.5' S, 19–23.iii.2004, elev. 1075 m (Fisher *et al.*); Prov. Toamasina, F.C. Andriantantely, 48° 48.8' E, 18° 41.7' S, 4–7.xii.1998, elev. 530 m (H.J. Ratsirarson); Prov. Toamasina, F.C. Didy, 48° 34.7' E, 18° 11.9' S, 16–23.xii.1998, elev. 960 m (H.J. Ratsirarson); Prov. Toamasina, F.C. Sandranantitra, 49° 5.5' E, 18° 2.9' S, 18–21.i.1999, elev. 450 m (H.J. Ratsirarson); Prov. Toamasina, Mahavelone (Foulpointe), 49° 30.0' E, 17° 40.0' S, 25.xii.1993 (A. Pauly); Prov. Toamasina, P.N. Mantadia, 48° 25.6' E, 18° 47.5' S, 25–28.xi.1998, elev. 895 m (H.J. Ratsirarson); Prov. Toliara, P.N. Andohahela, 3.8 km 113° ESE Mahamavo, 46° 45' E, 24° 46' S, 21–25.i.2002, elev. 900 m (Fisher *et al.*); 13 km NW Enakara, Res Andohahela, 46° 48' E, 24° 33' S, 30.xi.1992, elev. 1250 m (B.L. Fisher); 43 km S Ambalavao, Res. Andringitra, 47° 0' E, 22° 14' S, 10.x.1993, elev. 825 m (B.L. Fisher); 40 km S Ambalavao, Res. Andringitra, 46° 58' E, 22° 13' S, 15.x.1993, elev. 1275 m (B.L. Fisher); 38 km S Ambalavao, Res. Andringitra, 46° 58' E, 22° 12' S, 23.x.1993, elev. 1680 m (B.L. Fisher)

Notes. See under *P. myops* for discussion.

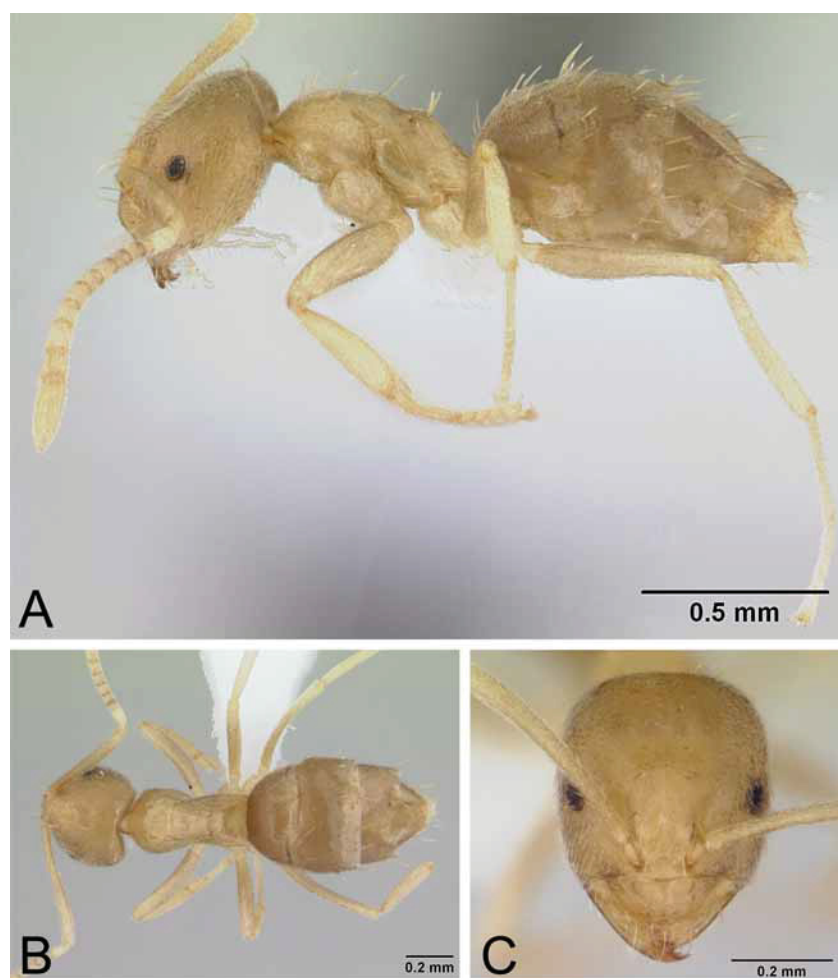


FIGURE 14. *Paraparatrechina ocellatula* worker holotype CASENT0416898. A, profile; B, dorsum; C, full face.

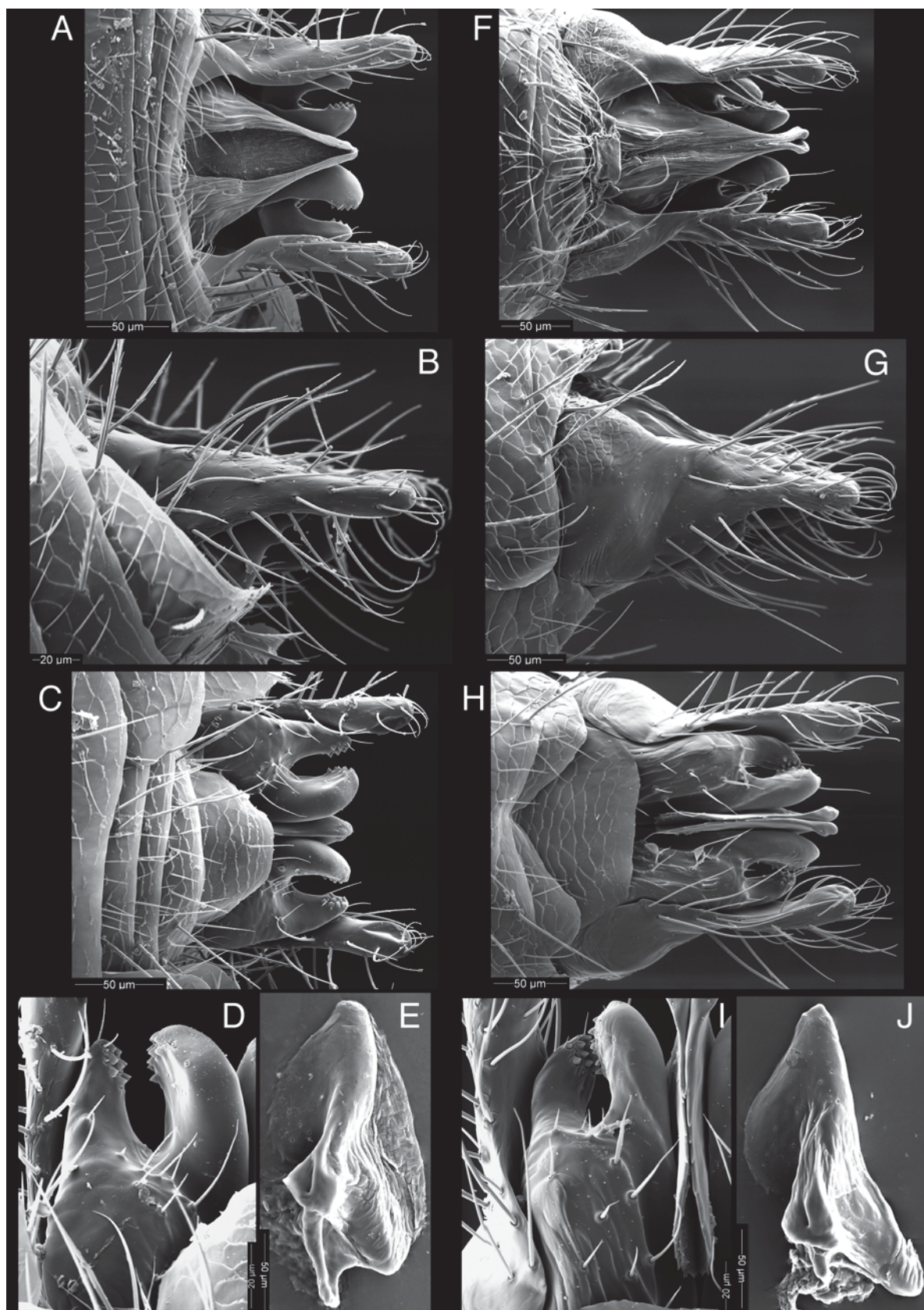


FIGURE 15. Scanning electron micrographs of *Parapatartrechina* male genitalia. *P. albipes* (A–E): A, dorsal view; B, lateral view; C, ventral view; D, digitus and cuspis; E, penis valve (ectal view). *P. glabra* (F–J): F, dorsal view; G, lateral view; H, ventral view; I, digitus and cuspis; J, penis valve (ectal view).

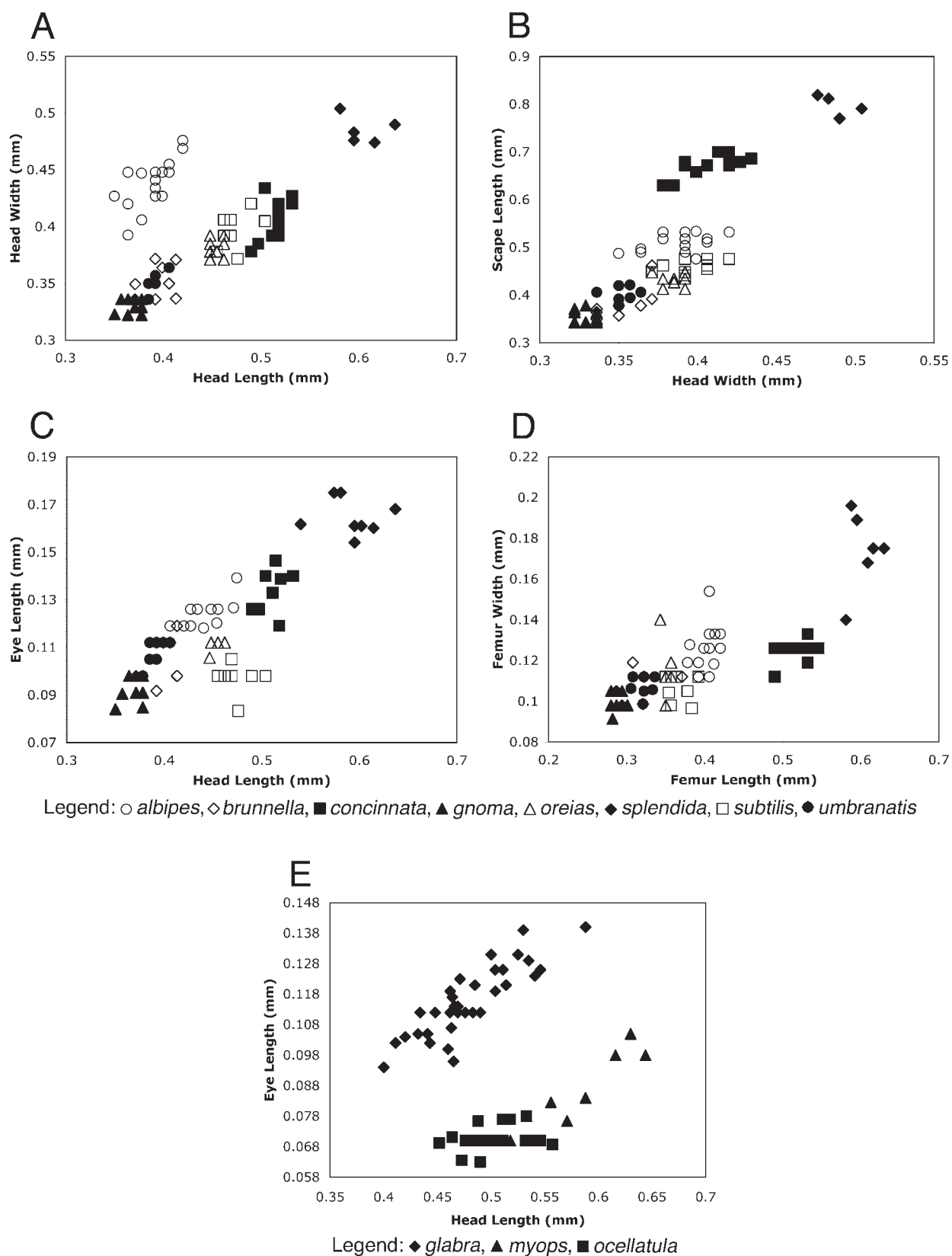


FIGURE 16. Various measurements of *Paraparatrechina* workers.

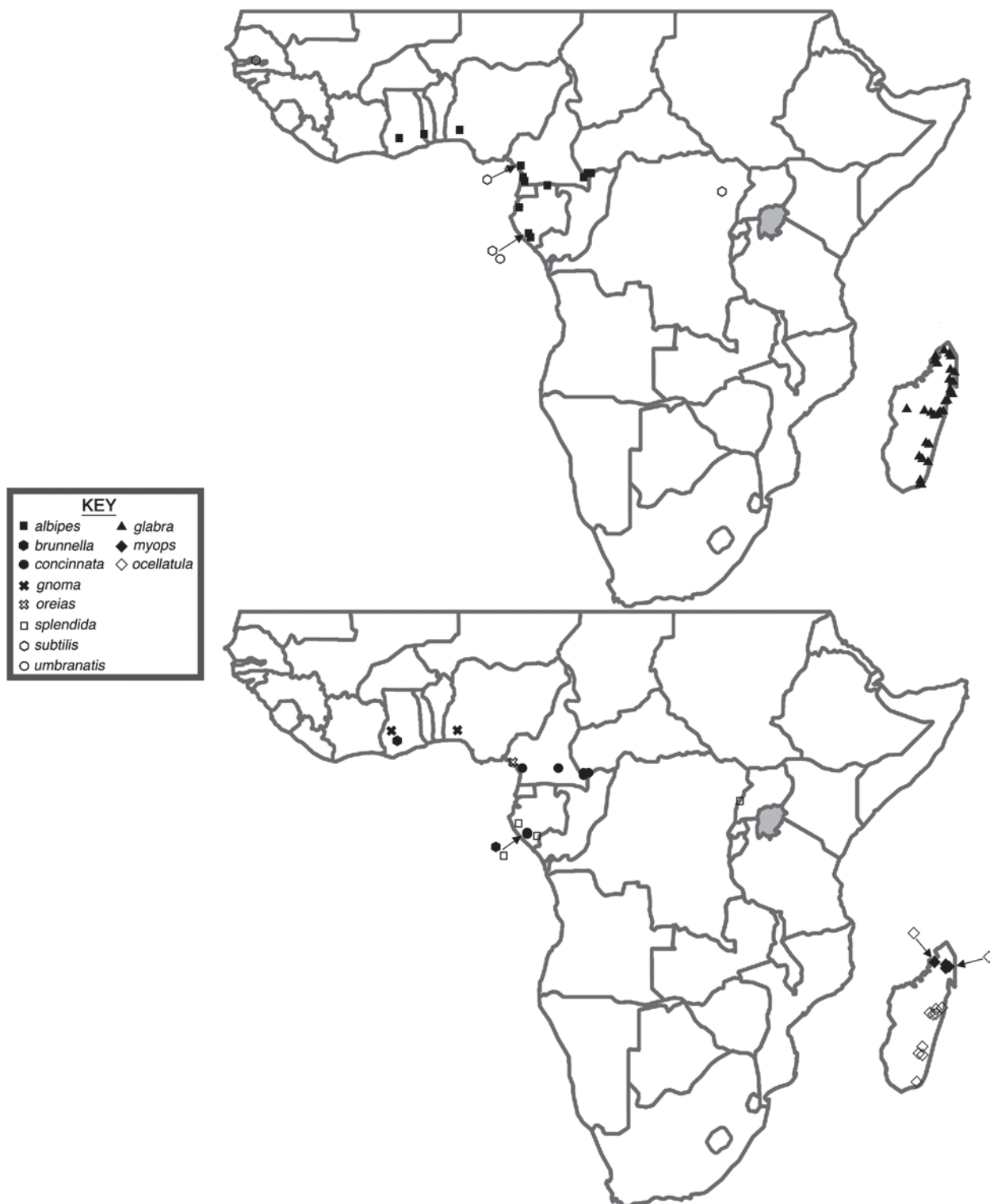


FIGURE 17. Distribution of *Parapatrechina* species. NOTE: The specimens of *brunnella* and *umbranatis* from Kenya were received after the proofing stage of this paper and are not included on the maps above. Instead, the Kenya locality records can be found under the non-type materials examined section of each species.

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